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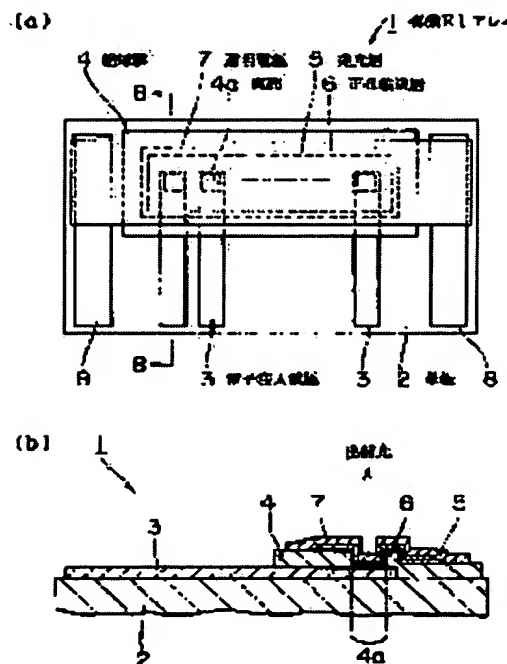
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(54) ORGANIC ELECTROLUMINESCENT ARRAY

(57)Abstract:

PROBLEM TO BE SOLVED: To avoid a trouble at the time of mounting multiple LED chips in a straight line, and lower the cost by manufacturing organic electroluminescent arrays on an insulating board such as glass, which can be formed long and narrow, at the same time.

SOLUTION: An organic array 1 as a light source of a print head is provided with plural electron injection electrodes 3, an insulating film 4 a light emitting layer 5, a positive hole transporting layer 6 and a transparent electrode 7 on an insulating rectangular substrate 2 made of glass. A part of each electron injection electrode 3 is coated so as to form the insulating film 4, and the insulation film 4 is formed with a window 4a, which is formed into a square with a plane view, at a part just over each electron injection electrode 3. This window is formed per each electron injection electrode so that the organic electroluminescent array has multiple light emitting dots. Area for light emission can be accurately regulated by accurately performing the patterning of the window 4a of the insulating film 4.



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JAPANESE

[JP,10-055890,A]

CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD PRIOR ART EFFECT OF THE
INVENTION TECHNICAL PROBLEM MEANS DESCRIPTION OF DRAWINGS DRAWINGS

[Translation done.]

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CLAIMS

[Claim(s)]

[Claim 1] Organic EL array which is characterized by providing the following and which has two or more luminescence dots An insulating substrate The electron-injection electrode of the aforementioned number of luminescence dots, and the abbreviation same number formed on this insulating substrate An insulator layer with the window part used as the luminescence dot which a part of each of these electron-injections electrode is covered, and it is formed on the aforementioned insulating substrate, and carries out opening in each right above section of this electron-injection electrode Transparent-electrode **** ** **** which covered the luminous layer formed in contact with each of an electron-injection electrode which covers the aforementioned window part and faces outside from the inside of this window part, the electron hole transporting bed which covered the right above position of the aforementioned window part, and was formed in contact with this on the aforementioned luminous layer, and this electron hole transporting bed and the aforementioned luminous layer, and was formed on the aforementioned insulating substrate in contact with this electron hole transporting bed


[Claim 2] Organic EL array characterized by establishing the crevice where the thickness becomes thin gradually the shape of the said heart toward the center of this window part at the portion located in the window part of the aforementioned insulator layer in the aforementioned electron-injection electrode in organic EL array according to claim 1.

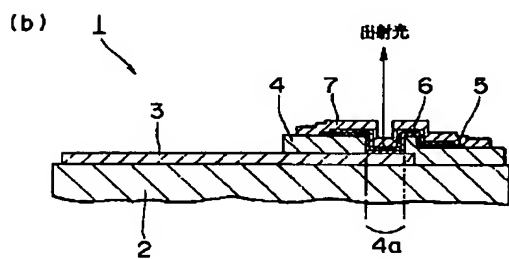
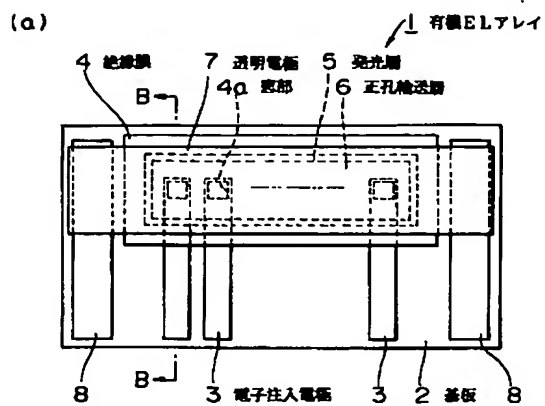
[Claim 3] Organic EL array characterized by forming two or more thin parts with thin thickness in the portion located in the window part of the aforementioned insulator layer at the aforementioned electron-injection electrode compared with other parts in organic EL array according to claim 1.

[Claim 4] In organic EL array according to claim 1, the 2nd insulator layer is prepared between the aforementioned insulating substrate and an electron-injection electrode. to this 2nd insulator layer It is organic EL array which the crevice where the thickness becomes thin gradually the shape of the said heart toward the center of this window part at the portion located in the window part of the aforementioned insulator layer is prepared, and is characterized by the aforementioned electron-injection electrode serving as the configuration where the configuration of this crevice was met on the aforementioned crevice.

[Claim 5] It is organic EL array which the side of the insulator layer which forms the aforementioned electron-injection electrode and this window part is worn into the portion located in the window part of the aforementioned insulator layer at least in organic EL array according to claim 1, and the 2nd electron-injection electrode is prepared, and is characterized by for the aforementioned luminous layer having covered the electron-injection electrode of the above 2nd, and forming it.

[Translation done.]

Drawing selection [R pr sentativ drawing] 



第1の実施形態例の概略構成図

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] this invention relates to organic EL (electroluminescence) array used suitable for the optical printer head in an electrophotography formula printer.

[0002]

[Description of the Prior Art] as the light source of an electro photographic printer -- the former, for example, ", -- an LED array printer head which is indicated by Society of Electrophotography of Japan 31st page - 36th page; LED printer (Suzuki **** Takasu [Hiromi], Fukatsu ****)" is known [of the 2 volume / 24th / No. (1985)] Since the LED array which is the light source is solid-state-ized as a head and there is no mechanical mechanical component like a LASER beam printer, high reliability is acquired, and since the optical path length is still shorter, the LED printer equipped with such an LED array printer head can be miniaturized. Moreover, since the LED array is produced by the semiconductor manufacturing technology with a mass-production actual result, it can expect low-cost-ization by mass-production-izing.

[0003] At the LED printer indicated in the aforementioned reference, the printing process is advanced in the following sequence. First, an electrification machine is used for a photoconductor drum and a uniform charge is given. Next, a photoconductor drum side is made to carry out image formation of the light from an LED array through a convergence nature rod-lens array, and a latent image is formed. Subsequently, you imprint [which was used as the visible image with the developing machine] on the recording paper after that, and make it established. Furthermore, cleaning of a remains toner and electric discharge of a rest potential are performed, and a printing process is ended. In addition, what has a sensitivity property suitable for the luminescence wavelength of Light Emitting Diode also about a photoconductor drum is developed.

[0004] Moreover, the LED array printer head equipped with the LED array in this LED printer has the substrate which formed the thick-film pattern in the ceramic substrate of an alumina, arranges a Light Emitting Diode chip in on a straight line in the center section of this substrate, carries out die bond of the IC chip to the both sides with a conductive paste, and performs electrical installation with wire bond. A signal and a power supply are supplied to a ceramic substrate through a FPC (flexible printed circuit board) substrate. Moreover, it is decided by cutting precision of a chip whether a Light Emitting Diode chip will be continuously connectable.

[0005] By the way, three properties are demanded of the material of Light Emitting Diode.

a) It is three, that isolation of light is made, that the diffusion process in which b densification is possible can be used, and acquiring [the property stabilized at a c economical price] **, and now is taken by that GaAsP which carried out the vapor growth is the optimal on a GaAs substrate as what fills such a demand.

[0006] In order to manufacture such a Light Emitting Diode, a diffusion prevention film is formed in an n type GaAsP wafer by CVD etc., and a luminescence aperture is opened in this by the photolithography method. Next, vacuum enclosure of a wafer and the P type impurity is carried out at quartz ampul, diffusion is performed at the temperature of about 700 degrees C for several hours, and a PN junction is formed in a luminescence aperture. At this time, 5-7 micrometers is suitable as the diffusion depth.

[0007] Subsequently, aluminum is turned on the P side, the vacuum evaporation of the Au alloy is carried out to the N side, respectively, and an ohmic electrode is formed. A light-emitting part size is decided in general by density (resolution), and is set to 40 micrometers by mm in 16 dots (pitch 62.5micrometer) /with it. The number of dots per one chip has 64 dots or 128 practical dots by the chip yield and the size. Luminescence wavelength is decided by material and set to 660nm in this example.

[0008] In the present condition, from level [**10% of] to **40% is contained in 1 wafer, the quantity of light variation in 1 chip is sorted out by proper inspection, and **20% or less of thing is used. The cutting precision of a Light Emitting Diode chip influences array precision, and less than **5-micrometer highly precise cutting technology is needed. The scribe method using the cleavage is used about cutting for this connection.

[0009]

[Problem(s) to be Solved by the Invention] However, in the above-mentioned LED array print head, there is un-arranging [which is described below about the LED array]. Dispersion in the performance between the elements resulting from the defect which is inherent in a wafer, the heterogeneity of a manufacturing process, etc. is unescapable. Now substrates, such as GaAs used as the substrate of an LED array, can produce only a thing with a size of about at most 3 inches, but, moreover, are expensive. Furthermore, the yield will become bad, if there are many defects of a crystal and they make [many] the number of dots with a monolithic type.

[0010] Then, although much array chips of the few number of dots are made, these are connected and it is made to cover all recording widths, an array error arises in a chip connection in that case, and it will become it is large and difficult [mounting to a bird clapper etc. and a substrate / from] very much / this array error / as it becomes high-density. The difficulty on such mounting is the big factor which spoils low-cost-izing and densification. The place which this invention was made in view of the aforementioned situation, and is made into the purpose avoids the difficulty on mounting, and is to offer organic EL array which can attain low-cost-izing and densification.

[0011]

[Means for Solving the Problem] The electron-injection electrode of the number of luminescence dots, and the abbreviation same number formed on the insulating substrate and this insulating substrate in organic EL array of this invention, An insulator layer with the window part used as the luminescence dot which a part of each of these electron-injections electrode is covered, and it is formed on the aforementioned insulating substrate, and carries out opening in each right above section of this electron-injection electrode, The luminous layer formed in contact with each of an electron-injection electrode which covers the aforementioned window part and faces outside from the inside of this window part, It made into the solution means of the aforementioned technical problem to have had the transparent electrode which covered the electron hole transporting bed which covered the right above position of the aforementioned window part, and was formed in contact with this on the aforementioned luminous layer, and this electron hole transporting bed and the aforementioned luminous layer, and was formed on the aforementioned insulating substrate in contact with this electron hole transporting bed.

[0012] Since it is collectively produced on the insulating substrate in which things made long and slender, such as glass, are possible according to this organic EL array, the difficulty on mounting of making much Light Emitting Diode chips arrange on a straight line is avoided like the conventional LED array. Moreover, it becomes possible to abolish loss of the light by the total

reflection in a glass rear face which happens when taking out light from the rear face of the substrate which consists of glass, for example, since it is considered as the structure which takes out light from the side which formed the window part of an insulator layer, i.e., the upper surface of an insulating substrate, and loss of the light by the absorption to glass, and to take out light outside efficiently.

[0013]

[Embodiments of the Invention] Hereafter, the example of an operation gestalt explains organic EL array of this invention in detail. Drawing 1 (a) and (b) are drawings showing the 1st example of an operation gestalt of this invention, and a sign 1 is organic EL array used as the light source of a print head in these drawings. This organic EL array 1 has many numbers of luminescence dots, with the insulation which consists of glass, on the substrate 2 of a rectangle tabular, is equipped with an insulator layer 4, a luminous layer 5, the electron hole transporting bed 6, and a transparent electrode 7, and is formed with two or more electron-injection electrode 3 --.

[0014] Electron-injection electrode 3 -- is a plane view rectangle-like thing, as shown in drawing 1 (a), is formed on the part substrate 2 of the number corresponding to the number of luminescence dots, and changes parallel into the state where set the predetermined interval, respectively and it was suitable in the direction of a shorter side of a substrate 2. As these electron-injections electrode 3 --, the low thing of a work function is desirable, it is specifically made suitable [a MgAg alloy, In, a MgIn alloy, a MgCu alloy, a MgLi alloy, etc.] so that easily [the electron injection to a luminous layer 5], in this example, a MgAg alloy is used and this is formed in 200nm in thickness.

[0015] Moreover, on the aforementioned substrate 2, a part of each aforementioned electron-injection electrode 3 -- is covered, and the insulator layer 4 is formed. Window part 4a which carries out opening to the shape of a plane view square in each right above section of aforementioned electron-injection electrode 3 -- is formed in this insulator layer 4. Window part 4a becomes a luminescence dot, and organic EL array becomes a thing with many luminescence dots by forming this window part 4a every electron-injection electrode 3. In addition, the reason which needs this insulator layer 4 is as follows.

[0016] Since a luminous layer 5 and the electron hole transporting bed 6 are organic films as mentioned later, the process of patterning using the photolithography method cannot be borne, therefore this patterning cannot be performed. The field where a deer is carried out and the electron-injection electrode 3 and the luminous layer 5 formed on an insulator layer 4 touch must form the area correctly, when specifying the field where luminescence occurs. Then, after forming the electron-injection electrode 3, form the insulator layer 4 in which exact patterning is possible between this electron-injection electrode 3 and the luminous layer 5 formed in behind, and this is made to be placed between them. And by joining the electron-injection electrode 3 and a luminous layer 5 through window part 4a formed in the insulator layer 4 By performing correctly patterning of window part 4a of this insulator layer 4 can prescribe correctly the area of the field where the electron-injection electrode 3 and a luminous layer 5 touch, i.e., the field where luminescence occurs. It is desirable to form for such a reason from the material which can attain the fine patternizing by the photolithography method as an insulator layer 4, and it is SiNx at this example. A film and SiOx A film etc. is used and this is formed in 300nm in thickness.

[0017] Moreover, on this insulator layer 4, the window part 4a is covered and the luminous layer 5 is formed. As this luminous layer 5 was mentioned above, it was formed in contact with each and electron-injection electrode 3 -- which faces outside from the inside of window part 4a of an insulator 4 consists of an organic film. It is also effective it to be desirable for the electron affinity to be 2.5eV or more, and it to specifically be supposed as this luminous layer 5, for that a metal chelate compound, polycyclic condensation or a conjugate aromatic hydrocarbon, benzoxazole or a benzothiazole derivative, a perylene system compound, a coumarin system

compound, etc. are suitable so that an electron may be easy to be poured in, and to dope fluorescence nature coloring matter, such as a pyran derivative, a coumarin derivative, a cyanine derivative, and a Quinacridone derivative, for wavelength control of luminescence or Moreover, the ionization potential of a luminous layer 5 must be lower than that of the electron hole transporting bed 6 so that the hole injection from the electron hole transporting bed 6 mentioned later to a luminous layer 5 may become easy. And based on such conditions, this is formed in 50nm in thickness with the vacuum deposition by resistance heating by this example, using an eight-quinolinol aluminum complex (Alq3) as a luminous layer 5. In addition, the mask vacuum evaporation to which the vacuum evaporation only of the field to form in is carried out as this vacuum deposition was adopted.

[0018] On this luminous layer 5, the right above position of window part 4a of an insulator layer 4 is covered, and the electron hole transporting bed 6 is formed. As this electron hole transporting bed 6, ionization potential needs to be a thing with the electron-donative low molecule or the substituent, and it needs to be transparent to luminescence wavelength, and is specifically a triphenylamine derivative, and a benzidine type, a styryl amine type, a diamine type, etc. are made suitable. And in this example, a diamine derivative (TPD) is used and it is formed in 50nm in thickness by the vacuum deposition by resistance heating like the aforementioned luminous layer 5.

[0019] Moreover, on the aforementioned substrate 2, the electron hole transporting bed 6 and a luminous layer 5 are covered, and the transparent electrode 7 is formed in contact with the electron hole transporting bed 5. This transparent electrode 7 consists of what has permeability to a translucency, i.e., luminescence wavelength, and in order that it may make easy pouring of the electron hole to the electron hole transporting bed 6 which is an organic film so that it may mention later and, it is desirable that a work function is a large conductor, and it is formed in 150nm in thickness of the indium-stannic-acid ghost (ITO) in this example. Moreover, this transparent electrode 7 covers the electron hole transporting bed 6 and a luminous layer 5, and since the electron hole transporting bed 6 and a luminous layer 5 are organic films, is formed for preventing degradation by air contact of these organic film.

[0020] This transparent electrode 7 is electrically connected with the common electrode 8 arranged at the both sides of a substrate 2 as shown in drawing 1 (a). This common electrode 8 is formed simultaneously with the electron-injection electrode 3. And the organic EL array 1 is what sandwiched the luminous layer 5 and the electron hole transporting bed 6 between each electron-injection electrodes 3 and transparent electrodes 7 in the portion of window part 4a of an insulator layer 4 at the basis of such composition.

[0021] Next, the organic EL array 1 of such composition is explained with reference to drawing 2 about the example at the time of applying to a print head. In drawing 2, a sign 1 is organic EL array shown in drawing 1 (a) and (b), and the substrate 2 of this organic EL array 1 is mounted on the drive circuit board 9 with the driver IC 10. As for the drive circuit board 9 and the driver IC 10, electrical installation is made by the bonding wire 11. Similarly, electrical installation is made by the bonding wire 11, respectively also about the substrate 2 of a driver IC 10 and the organic EL array 1 and the substrate 2 of the organic EL array 1, and the drive circuit board 9.

[0022] The convergence nature rod-lens array 12 and the photoconductor drum 13 are arranged in the upper part [of the organic EL array 1], i.e., the upper surface of substrate 2 of organic EL array 1, side by this order. And outgoing radiation of the light emitted from the organic EL array 1 on the basis of such composition is carried out to the upper surface side of a substrate 2, and it is condensed by the photoconductor drum 13 through the convergence nature rod-lens array 12.

[0023] Next, based on the composition of a print head shown in drawing 2, operation of the organic EL array 1 shown in drawing 1 (a) and (b) is explained. First, in drawing 2, the data of a content to print are sent to the driver IC 10 on the drive circuit board 9. Then, in the organic EL array 1 shown in drawing 1 (a) and (b), voltage is impressed so that data may become the

electron-injection electrode 3 with a negative potential at the dot (window part 4a) of "ON", in view of the common electrode 8. Here, "ON" and "OFF" are decided by existence of generating of the voltage difference between the electron-injection electrodes 3 and the common electrodes 8 by switch of two level of the applied voltage to the electron-injection electrode 3 set up beforehand.

[0024] In "ON", it operates as follows. Supply current is supplied to the common electrode 8 through a bonding wire 11, and flows to a transparent electrode 7 further. Consequently, the hole injection into the electron hole transporting bed 6 happens. On the other hand, the electron injection to a luminous layer 5 is similarly generated by the electron-injection electrode 3. The movement is blocked by the difference of the electron affinity of a luminous layer 5 and the electron hole transporting bed 6, when the electron poured into the luminous layer 5 moves toward the electron hole transporting bed 6 in the inside of a luminous layer 5 and an interface with the electron hole transporting bed 6 is arrived at.

[0025] However, if the electron hole poured into the electron hole transporting bed 6 moves toward the luminous layer 5 in the inside of the electron hole transporting bed 6 and arrives at an interface with a luminous layer 5, it is easily poured in into this luminous layer 5, and is recombined with the electron which was standing by there. And the excitation of an eight-quinolinol aluminum complex (Alq3) in which this recombination energy forms a luminous layer 8 is caused, and further, when returning from this excitation state to a ground state, fluorescence with a luminescence wavelength of 540nm is emitted.

[0026] The light by the side of a transparent electrode 7 penetrates a transparent electrode 7 as it is among the light generated by such mechanism, on the other hand, the light by the side of the electron-injection electrode 3 is reflected by this electron-injection electrode 3, and both are taken out by the upper surface shell exterior of a substrate. And as shown in drawing 2, through the convergence nature rod-lens array 12, the light taken out by this exterior condenses to a photoconductor drum 13, and carries out required time irradiation. The point operates like the usual electrophotography method printer from here. In addition, since the potential difference does not have data between a transparent electrode 7 and the electron-injection electrode 3 at the dot (window part 4a) of "OFF", current does not flow and, thereby, luminescence does not take place by this dot.

[0027] Therefore, if it is in such an organic EL array 1, since it can produce collectively on one substrate 2, like the conventional LED array, the difficulty on mounting of making much Light Emitting Diode chips arrange on a straight line can be avoided, and low-cost-ization can be attained. Moreover, since it considered as the structure which takes out light from the upper surface side of a substrate 2, and loss of the light by the total reflection in a glass rear face which happens when taking out light from the rear face of the substrate which consists of glass, for example, and loss of the light by the absorption to glass can be abolished, light can be taken out outside efficiently and a strong light can be taken out by this in a short time, improvement in the speed of printing by the printer can be enabled.

[0028] Drawing 3 (a) and (b) are drawings showing the 2nd example of an operation gestalt of this invention, and a sign 20 is organic EL array in these drawings. The place where this organic EL array 20 differs from the organic EL array 1 shown in drawing 1 (a) and (b) is the point that crevice 21a to which the thickness becomes thin gradually the shape of the said heart toward the center of window part 4a of an insulator layer 4 at the electron-injection electrode 21 is prepared.

[0029] That is, crevice 21a stair-like into the portion located in window part 4a of an insulator layer 4 is formed in the electron-injection electrode 21 of the organic EL array 20 in this example of an operation form. This crevice 21a was taken toward the center of window part 4a of an insulator layer 4, the thickness of the electron-injection electrode 21 was thinly formed of the bird clapper stair-like gradually, and a plane view square-like crevice is dented and formed in two stages in this example, and the depression of these 2 stage is formed in the shape of the

said heart to the center of window part 4a. Here, the reason which can dent crevice 21a in the shape of the said heart is for making it a direction dependency not appear in the outgoing radiation intensity of light.

[0030] Moreover, in this crevice 21a, the field of the shape of drawing 3 (a) and a plane view square shown in [P] (b) serves as a portion which is a core and was formed most thinly, and the field of the shape of the field of the outside of this P field, i.e., drawing 3 , (a), and a plane view square frame shown in [Q] (b) serves as a portion formed thinly next. In this example of an operation form, thickness of the field shown by P which is the thinnest portion of a core was set to 100nm, and the level difference per step of the stairway in crevice 21a was set to 1 micrometer. Therefore, the thickness of the thickest portion of the electron-injection electrode 21 is set to 2.1 micrometers, and the thickness of the field shown by Q is set to 1.1 micrometers. In addition, about the configuration of such stair-like crevice 21a, since it is easily processible conventionally with a phot well-known lithography technology and etching technology, the explanation is omitted here.

[0031] After forming the electron-injection electrode 21 naturally and forming crevice 21a by ETCHIGGU further in manufacture of the organic EL array 20 with such an electron-injection electrode 21, formation of an insulator layer 4 and processing of the window part 4a are performed. And although a luminous layer 5, the electron hole transporting bed 6, and a transparent electrode 7 are formed one by one on it, since window part 4a of an insulator layer 4 is formed so that the aforementioned crevice 21a may be located in the interior, this crevice 21a will be exposed outside (upper surface side) within window part 4a. Therefore, by forming a luminous layer 5 in contact with this crevice 21a, as shown in drawing 3 (b), a stair-like crevice is seemingly formed also in this. Furthermore, an apparent stair-like crevice is similarly formed in the electron hole transporting bed 6 and a transparent electrode 7.

[0032] Thus, by forming crevice 21a in the electron-injection electrode 21, by the usual manufacture method, the rest is seen also in a luminous layer 5, the electron hole diffusion layer 6, and a transparent electrode 7, and can form the upper crevice. Therefore, compared with the thing of the 1st example of an operation gestalt, the surface area itself is large, from a bird clapper, the luminescence area also becomes large and, naturally, thereby, the luminous layer 5 especially formed in window part 4a of an insulator layer 4 can increase the total amount of the outgoing radiation light around unit time. And the total amount of the light which condenses to a photoconductor drum 13 through the convergence nature rod-lens array 12 as shown in drawing 2 can be increased by the ability increasing the total amount of outgoing radiation light in this way. That is, the total amount of the light around [which is condensed by the photoconductor drum 13] unit time can be increased by enlarging luminescence area.

[0033] This means that the luminescence time for performing printing for which it asks so that it may mention later can be shortened in printer head composition as shown in drawing 3 . However, you have to enlarge luminescence area, without enlarging window part 4a of an insulator layer 4 in enlarging luminescence area. because, window part 4a of an insulator layer 4 -- extending (it enlarging) -- it is because fixing of a toner will lap with the next dot and a quality of printed character will be spoiled, if the phenomenon separation of light becomes impossible between adjacent dots (window parts 4a and 4a) happens and such a phenomenon happens

[0034] In the organic EL array 20 of this example of an operation gestalt, without extending window part 4a of an insulator layer 4 by having formed crevice 21a in the electron-injection electrode 21, as mentioned above, it has structure which enlarged luminescence area, therefore can avoid un-arranging [that the aforementioned quality of printed character is spoiled]. The result which asked below for the ability of the organic EL array 20 of this example of an operation gestalt to shorten [how much luminescence time] by calculation is shown.

[0035] Total amount Pt of one luminescence dot (organic [EL]), i.e., the outgoing radiation light around unit time from one window part 4a, It is proportional to the luminescence area A. It is as

follows when this is expressed with a formula.

$$P_t = a \times A \quad \text{--- (1)}$$

Here, a is the total amount of unit time and the outgoing radiation light per unit area, and is decided by the property organic [EL].

[0036] By the way, in the light source in the optical printer of an electrophotography method especially an LED array, or organic EL array of this invention, if the density of a luminescence dot is decided, the size of these luminescence dot and area will be decided almost automatically. It is because the phenomenon exposed to the next dot occurs if too small and it is [the amount of light itself decreases and] too large. Then, the area of the luminescence dot formed with the optimal size is fixed as S . This S corresponds to the area of window part 4a of an insulator layer 4 in this example of an operation gestalt. And it is P_s about the total amount of the outgoing radiation light around [which can be taken out from this S] unit time. If it carries out, since luminescence area can be increased in fixed S in this example of an operation gestalt, if the increment of the luminescence area by formation of crevice 21a is set to α , it is P_s about the total amount of outgoing radiation light. It can express as follows.

$$P_s = a \times (S + \alpha) \quad \text{--- (2)}$$

[0037] Total amount P_s of the outgoing radiation light around [which is emitted from window part 4a of an insulator layer 4] unit time Inside, The total amount around [which the convergence nature rod-lens array 12 shown in drawing 2 is penetrated, and is further irradiated by the photoconductor drum 13] photometric-units time (luminescence power is called hereafter.) PD When efficiency in consideration of the probability which can carry out incidence to the convergence nature rod-lens array 12, the probability which can penetrate the convergence nature rod-lens array 12 is set to η , it can express with the following formulas.

$$PD = P_s \times \eta \quad \text{--- (3)}$$

Furthermore, it is as follows if a formula (2) is substituted for a formula (3).

$$PD = a \times (S + \alpha) \times \eta \quad \text{--- (4)}$$

[0038] Next, when luminescence time is set to T , the total amount E of the light which contributes to exposure, i.e., exposure energy, can be expressed with the following formulas.

$$E = PD \times T \quad \text{--- (5)}$$

It is as follows if a formula (3) is substituted for a formula (5).

$$E = P_s \times \eta \times T \quad \text{--- (6)}$$

It is as follows if a formula (2) is substituted for a formula (6).

$$E = a \times (S + \alpha) \times \eta \times T \quad \text{--- (7)}$$

If this is expressed about T , it will become the following.

$$T = E / \{ a \times \eta \times (S + \alpha) \} \quad \text{--- (8)}$$

Moreover, since the total amount E of the light which contributes to exposure, i.e., exposure energy, is fixed, it is as follows.

$$T = K / (S + \alpha) \quad \text{--- (9)}$$

Here, $K = E / \{ a \times \eta \}$ is a constant.

[0039] Next, luminescence time explains concretely which was shortened by this example of an operation gestalt using a numeric value. A length of one sides of P [in / $S = 15 \text{ micrometer} \times 15 \text{ micrometer} = 225 \text{ micrometer}^2$ and drawing 3 (b) / for the area (S) of window part 4a of an insulator layer 4] and Q was set to 5 micrometers and 10 micrometers. Therefore, the area (α) which increased by crevice 21a is set to $\alpha = 1 \text{ micrometer (level difference)} \times 10 \text{ micrometer (one-side length)} \times 4 \text{ (number of neighboring)} + 1 \text{ micrometer (level difference)} \times 5 \text{ micrometer (one-side length)} \times 4 \text{ (number of neighboring)} = 60 \text{ micrometer}^2$.

[0040] Therefore, it is set to $(S + \alpha) / S = 1.27$, and luminescence area becomes the increase of 27%. In addition, according to survey, it is the actual luminescence power PD. It was increasing about 50%. That is, it is actual PD although only an area increment increases due to a formula (4). It becomes large more than it is expressed with a formula (4). For the luminescence time T , this is not the formula (9) showing only the area effect but the actual luminescence

power PD. It is thought that it is because a formula (5) is followed since it is determined.

[0041] Thus, if it was in the organic EL array 20 of this example of an operation gestalt, since crevice 21a was formed in the electron-injection electrode 3, compared with the case where this is not formed, luminescence power can be increased 1.5 times, and, thereby, luminescence time can be shortened to 3 by about 2/. and luminescence time -- about -- it can be made two thirds -- time required for printing per line -- about -- the printing speed which it can be shortened to two thirds, therefore can be printed to around unit time can be increased about 1.5 times That is, in this example of an operation gestalt, printing speed can be directly made quick only by configuration processing of the electron-injection electrode 3. In addition, in this invention, if it is the configuration to which the thickness of the electron-injection electrode 3 becomes thin gradually the shape of the said heart toward the center of window part 4a of an insulator layer 4, without being limited to the configuration shown in drawing 3 (a) and (b) about the configuration of a crevice, of course, the configuration which has three or more steps of level differences, for example, the configuration gradually dented in the shape of a taper are sufficient.

[0042] Drawing 4 (a) and (b) are drawings showing the 3rd example of an operation gestalt of this invention, and a sign 30 is organic EL array in these drawings. The place where this organic EL array 30 differs from the organic EL array 1 shown in drawing 1 (a) and (b) is the point that four thin part 31a with thin thickness is formed in the electron-injection electrode 31 compared with other parts. That is, four thin part 31a is formed in the portion located in window part 4a of an insulator layer 4 at the electron-injection electrode 31 of the organic EL array 30 in this example of an operation gestalt. Thin part 31a is a plane view square-like thing, and as shown in drawing 4 (a), it is equally arranged from the center of this window part 4a at the four-corners section of window part 4a. Here, the reason which has arranged four thin part 31a equally from a center in this way is for making it a direction dependency not appear in the outgoing radiation intensity of light like the case of the 2nd example of an operation gestalt.

[0043] As for thin part 31a, the thickness is set to 100nm in the electron-injection electrode 3, and the level difference with other parts of the electron-injection electrode 3 is set to 1 micrometer. Namely, as for the electron-injection electrode 3, the thickness of parts other than thin part 31a is formed in 1.1 micrometers. In addition, since it is easily processible conventionally also about such thin part 31a with a phot well-known lithography technology and etching technology, the explanation is omitted.

[0044] Moreover, after forming the electron-injection electrode 21 naturally and forming crevice 21a by ETCHIGGU further in manufacture of the organic EL array 20 with such an electron-injection electrode 21, formation of an insulator layer 4 and processing of the window part 4a are performed. And although a luminous layer 5, the electron hole transporting bed 6, and a transparent electrode 7 are formed one by one on it, since window part 4a of an insulator layer 4 is formed so that the aforementioned crevice 21a may be located in the interior, this crevice 21a will be exposed outside (upper surface side) within window part 4a. Therefore, a luminous layer 5 is seen also in this, as by being formed in contact with this crevice 21a showed to drawing 3 (b), and the upper crevice is formed. Furthermore, an apparent crevice is similarly formed in the electron hole transporting bed 6 and a transparent electrode 7.

[0045] Moreover, like the example of an operation gestalt of the above 2nd, by forming thin part 31a-- in the electron-injection electrode 21 in this way, the rest is seen also in a luminous layer 5, the electron hole diffusion layer 6, and a transparent electrode 7, and can form the upper crevice by the usual manufacture method. Therefore, even if it is in this 3rd example of an operation gestalt, compared with the thing of the 1st example of an operation gestalt, the surface area itself is large, from a bird clapper, the luminescence area also becomes large and, naturally, thereby, the luminous layer 5 especially formed in window part 4a of an insulator layer 4 can increase the total amount of the outgoing radiation light around unit time. And even if it is in this 2nd example of operation gestalt organic EL array 30 by the ability increasing the total

amount of outgoing radiation light in this way, as mentioned above, the total amount of the light which condenses to a photoconductor drum 13 through the convergence nature rod-lens array 12 in the composition of drawing 2 can be increased, and the total amount of the light around [which is condensed by the photoconductor drum 13 by this] unit time can be increased.

[0046] The result which asked below for the ability of the organic EL array 30 of this example of an operation gestalt to shorten [how much luminescence time] concretely by calculation using the numeric value like the case of the 2nd example of an operation gestalt is shown. A length [in / the plane view configuration of $S=15\text{micrometer}\times15\text{micrometer}=225\text{micrometer}^2$ and thin part 31a / for the area (S) of window part 4a of an insulator layer 4] of one side was set to 5 micrometers. Therefore, area which increased by four thin part 31a (alpha)
 $\alpha=1\text{micrometer}(\text{level difference})\times5\text{micrometer}(\text{one-side length})\times4(\text{number of neighboring})\times4(\text{the number of thin parts})$

$= 80\text{micrometer}^2$ It becomes. Therefore, it is set to $(S+\alpha) / S = 1.36$, and luminescence area becomes the increase of 36%. In addition, according to survey, it is the actual luminescence power PD. It was increasing about 70%. This is considered because the same effect as the case of the 2nd example of an operation gestalt has occurred.

[0047] Thus, if it was in the organic EL array 30 of this example of an operation gestalt, since thin part 31a-- was formed in the electron-injection electrode 3, compared with the case where this is not formed, luminescence power can be increased 1.7 times, and, thereby, luminescence time can be shortened to 5 by about 3/. and luminescence time -- about -- it can be made three fifths -- time required for printing per line -- about -- the printing speed which it can be shortened to three fifths, therefore can be printed to around unit time can be increased about 1.7 times That is, in this example of an operation gestalt, only by configuration processing of the electron-injection electrode 3, since printing speed can be directly made quick and four thin part 31a-- can moreover be once formed at an etching process, a process can be simplified and, thereby, low-cost-ization can also be attained. in addition, without it being alike and being limited to four about the number of thin part 31a, it is plurality, and if a manufacture top is possible, it is good in this invention, without limit

[0048] Drawing 5 (a) and (b) are drawings showing the 4th example of an operation form of this invention, and a sign 40 is organic EL array in these drawings. The place where this organic EL array 40 differs from the organic EL array 1 shown in drawing 1 (a) and (b) is the point that the 2nd insulator layer 41 is formed between a substrate 2 and the electron-injection electrode 3, and crevice 41a to which the thickness becomes thin stair-like gradually toward the center of window part 4a of an insulator layer 4 at this 2nd insulator layer 41 is prepared.

[0049] That is, formation of the electron-injection electrode 3 is preceded in the organic EL array 40 in this example of an operation form, and it is SiNX on a substrate 2. A film and SiOX The 2nd insulator layer 41 which consists of a film is formed. Crevice 41a of the same configuration as crevice 21a formed in the electron-injection electrode 21 in the 2nd example of an operation form is formed in this 2nd insulator layer 41. That is, this crevice 41a was also taken toward the center of window part 4a of an insulator layer 4 like the aforementioned crevice 21a, the thickness of the 2nd insulator layer 41 was thinly formed of the bird clapper stair-like gradually, and a plane view square-like crevice is dented and formed in two stages, and the depression of these 2 stage is formed in the shape of the said heart to the center of window part 4a. And the electron-injection electrode 3 is the thing of a configuration in alignment with the configuration of this crevice 41a by being formed on the 2nd insulator layer 41 in which such crevice 41a was formed.

[0050] In addition, also in this crevice 41a, the field of the shape of drawing 5 (a) and a plane view square shown in [P] (b) serves as a portion which is a core and was formed most thinly, and the field of the shape of the field of the outside of this P field, i.e., drawing 5 , (a), and a plane view square frame shown in [Q] (b) serves as a portion formed thinly next. And in this example of an operation form, thickness of the field shown by P was set to 100nm like crevice

21a in the 2nd example of an operation form, and the level difference per step of the stairway in crevice 41a was set to 1 micrometer. Therefore, the thickness of the thickest portion of the 2nd insulator layer 41 is set to 2.1 micrometers, and the thickness of the field shown by Q is set to 1.1 micrometers. About the configuration of such stair-like crevice 41a, since it is easily processible conventionally with a phot well-known lithography technology and etching technology, the explanation is omitted. Moreover, the reason which can dent crevice 41a in the shape of the said heart is for making it a direction dependency not appear in the outgoing radiation intensity of light like the 2nd example of an operation form.

[0051] As mentioned above, after forming the 2nd insulator layer 41 and forming crevice 41a by ETCHIGGU further in manufacture of the organic EL array 40 with such 2nd insulator layer 41, formation of the electron-injection electrode 3, formation of an insulator layer 4, and processing of the window part 4a are performed. At this time, as by being formed in contact with this crevice 41a showed the electron-injection electrode 3 to drawing 5 (b), a stair-like crevice is seemingly formed also in this. Subsequently, although a luminous layer 5, the electron hole transporting bed 6, and a transparent electrode 7 are formed one by one on an insulator layer 4, since window part 4a of an insulator layer 4 is formed so that the aforementioned crevice 41a may be located in the interior, the apparent crevice of the electron-injection electrode 3 formed on this crevice 41a will be exposed outside (upper surface side) within window part 4a. Therefore, a respectively apparent stair-like crevice is formed also in a luminous layer 5, the electron hole transporting bed 6, and a transparent electrode 7.

[0052] Thus, by forming crevice 41a in the 2nd insulator layer 41, by the usual manufacture method, the rest is seen also in the electron-injection electrode 3, a luminous layer 5, the electron hole diffusion layer 6, and a transparent electrode 7, and can form the upper crevice. Therefore, compared with the thing of the 1st example of an operation form, the surface area itself becomes large by the stair-like configuration and bird clapper corresponding to the configuration of crevice 41a in the luminous layer 5 especially formed in window part 4a of an insulator layer 4. Therefore, even if it is in the thing of this example of an operation form, greatly, from the bird clapper, the luminescence area can increase the total amount of the outgoing radiation light around unit time, and, naturally can increase the total amount of the light around [which is condensed by the photoconductor drum 13 in the composition which this showed to drawing 2] unit time.

[0053] In addition, it is easy to crystallize a luminous layer 5 and the electron hole transporting bed 6 in a portion with a level difference, and once it crystallizes these, the crystalline region will spread. And if this trespasses even upon a luminescence field, the portion will become the dark spot which does not emit light, will become what forms a point defect, and will spoil a quality of printed character remarkably. Therefore, as for an unnecessary level difference configuration, not giving as much as possible is desirable. In this example of an operation form, since the shape of toothing is formed only in the window part 4 of an insulator layer with the need of enlarging luminescence area, formation of the point defect accompanying crystallization of a luminous layer 5 or the electron hole transporting bed 6 can be suppressed to the minimum, and improvement in the yield can be aimed at.

[0054] The result which asked below for the ability of the organic EL array 40 of this example of an operation gestalt to shorten [how much luminescence time] concretely by calculation using the numeric value like the case of the 2nd example of an operation gestalt is shown. A length of one sides of P [area / (S) / of window part 4a of an insulator layer 4] in $S = 15$ micrometer \times 15-micrometer=225-micrometer² and drawing 5 (b) and Q was set to 5 micrometers and 10 micrometers. Therefore, the area (α) which increased by crevice 41a is set to $\alpha = 1 \text{ micrometer (level difference)} \times 10 \text{ micrometer (one-side length)} \times 4 \text{ (number of neighboring)} + 1 \text{ micrometer (level difference)} \times 5 \text{ micrometer (one-side length)} \times 4 \text{ (number of neighboring)} = 60 \text{ micrometer}^2$. Therefore, it is set to $(S + \alpha) / S = 1.27$, and luminescence area becomes the increase of 27%. In addition, according to survey, it is the actual luminescence

power PD. It was increasing about 50%. This is considered because the same effect as the case of the 2nd example of an operation gestalt has occurred.

[0055] Thus, if it was in the organic EL array 40 of this example of an operation gestalt, since crevice 41a was formed in the 2nd insulator layer 41, compared with the case where this is not formed, luminescence power can be increased 1.5 times, and, thereby, luminescence time can be shortened to 3 by about 2/. and luminescence time -- about -- it can be made two thirds -- time required for printing per line -- about -- the printing speed which it can be shortened to two thirds, therefore can be printed to around unit time can be increased about 1.5 times That is, in this example of an operation gestalt, printing speed can be directly made quick only by configuration processing of the electron-injection electrode 3. In addition, in this invention, if it is the configuration to which the thickness of the 2nd insulator layer 4 becomes thin gradually the shape of the said heart toward the center of window part 4a of an insulator layer 4, without being limited to the configuration shown in drawing 5 (a) and (b) about the configuration of a crevice, of course, the configuration which has three or more steps of level differences, for example, the configuration gradually dented in the shape of a taper are sufficient.

[0056] Drawing 6 (a) and (b) are drawings showing the 5th example of an operation form of this invention, and a sign 50 is organic EL array in these drawings. The place where this organic EL array 50 differs from the organic EL array 1 shown in drawing 1 (a) and (b) the side of the insulator layer 4 which forms each electron-injection electrode 3 and this window part 4a is worn into the portion located in window part 4a of an insulator layer 4, and the 2nd electron-injection electrode 51 prepares in it -- having -- a luminous layer 5 -- this -- it is the point which covers the 2nd electron-injection electrode 51 and is formed

[0057] Namely, it sets to the organic EL array 50 in this example of an operation gestalt. After forming electron-injection electrode 3 and forming an insulator layer 4 and its window part 4a further, in contact with the side of the insulator layer 4 which covers this in contact with the electron-injection electrode 3, and forms window part 4a, the insulator layer 4 for a periphery of this window part 4a is also covered for this with a wrap, and the 2nd electron-injection electrode 51 is formed. As this 2nd electron-injection electrode 51, the low thing of a work function is desirable, it is specifically made suitable [a MgAg alloy, In, a MgIn alloy, a MgCu alloy, a MgLi alloy, etc.] so that easily [the electron injection to a luminous layer 5], in this example, a MgAg alloy is used and this is formed in 100nm in thickness. However, in this example of an operation gestalt, since it stops being almost related to the electron injection to a luminous layer 5 about the electron-injection electrode 3, a work function does not need to consider as a low thing, therefore aluminum is used.

[0058] If it is in the organic EL array 50 of this example of an operation form Since the side of the insulator layer 4 which forms each electron-injection electrode 3 and this window part 4a for the 2nd electron-injection electrode 51 was worn and formed Also in the window part 4a side of the insulator layer 4 which causes optical leakage in window part 4a especially, by covering this by the 2nd electron-injection electrode 51, it reflects without the generated light leaking on this side, and is taken out as an outgoing radiation light. Consequently, total amount PS of outgoing radiation light It can enlarge.

[0059] The result which asked below for the ability of the organic EL array 50 of this example of an operation form to shorten [how much luminescence time] concretely by calculation using the numeric value like the case of the 2nd example of an operation form is shown. The amount of the light which it is newly reflected by the 2nd electron-injection electrode 51, and can be taken out outside as an outgoing radiation light is equivalent to the following reflector product increase parts beta.

a part for reflector product increase -- $\beta = 0.3 \text{ micrometer (thickness of insulator layer)} \times 15 \text{ micrometer (one-side length of window part)} \times 4 \text{ (number of neighboring)} = 18 \text{ micrometer}^2$ -- here, PD2 is as follows when luminescence power obtained when only beta increases a reflector product is set to PD2

Although $PD_2 = PD / (S + \beta) S = 1.08P$ luminescence area does not change, a reflector product becomes the increase of 8%. In addition, according to survey, the actual luminescence power PD_2 was increasing about 20%. here -- it should observe -- it is the point which has not changed luminescence area. If luminescence area becomes large, luminescence power will go up, and [instead] you also have to increase supply current. However, luminescence power can be raised in this example of an operation gestalt, without increasing supply current, since luminescence power can be raised without enlarging luminescence area.

[0060] Thus, if it was in the organic EL array 50 of this example of an operation gestalt, since the side of the insulator layer 4 which forms each electron-injection electrode 3 and this window part 4a for the 2nd electron-injection electrode 51 was worn and formed, compared with the case where this is not formed, luminescence power can be increased 1.2 times, and, thereby, luminescence time can be shortened to 5 by about 4/. and luminescence time -- about -- it can be made four fifths -- time required for printing per line -- about -- the printing speed which it can be shortened to four fifths, therefore can be printed to around unit time can be increased about 1.2 times. Moreover, since luminescence power can be raised in this example of an operation gestalt, without increasing supply current, luminous efficiency can be improved and, thereby, reduction-ization of the consumed electric current can be attained.

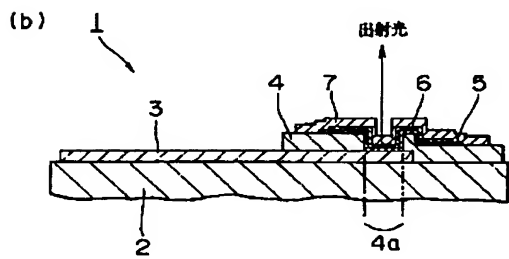
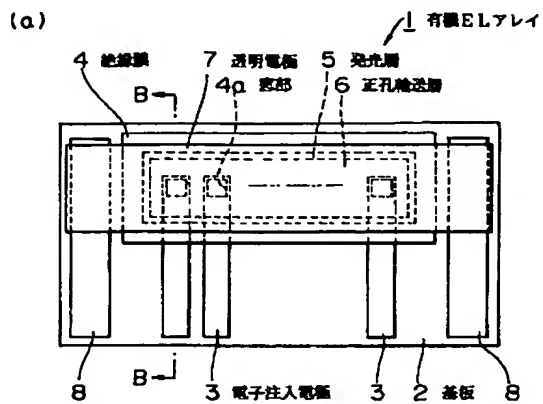
[0061]

[Effect of the Invention] As explained above, since organic EL array of this invention can be put in block on an insulating substrate and can be produced, like the conventional LED array, it can avoid the difficulty on mounting of making much Light Emitting Diode chips arrange on a straight line, and, thereby, can attain low-cost-ization. Moreover, since it considered as the structure which takes out light from the side which formed the window part of an insulator layer, i.e., the upper surface of an insulating substrate. For example, loss of the light by the total reflection in a glass rear face which happens when taking out light from the rear face of the substrate which consists of glass, Since loss of the light by the absorption to glass can be abolished, light can be taken out outside efficiently and a strong light can be taken out by this in a short time, improvement in the speed of printing by the printer can be enabled.

[Translation done.]

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Drawing selection [Representativ drawing] ☒



第1の実施形態例の概略構成図

[Translation done.]

JAPANESE

[JP,10-055890,A]

CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD PRIOR ART EFFECT OF THE
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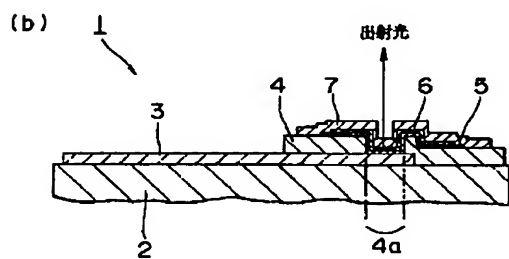
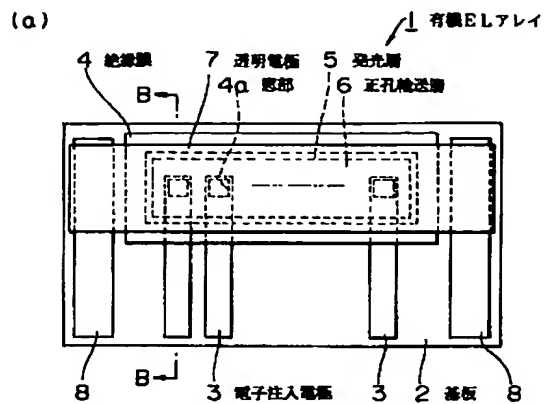
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TECHNICAL FIELD

[The technical field to which invention belongs] this invention relates to organic EL (electroluminescence) array used suitable for the optical printer head in an electrophotography formula printer.

[Translation done.]

Drawing selection [Representative drawing] 



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PRIOR ART

[Description of the Prior Art] as the light source of an electro photographic printer -- the former, for example, ", -- an LED array printer head which is indicated by Society of Electrophotography of Japan 31st page - 36th page; LED printer (Suzuki **** Takasu [Hiromi], Fukatsu ****)" is known [of the 2 volume / 24th / No. (1985)] Since the LED array which is the light source is solid-state-ized as a head and there is no mechanical mechanical component like a LASER beam printer, high reliability is acquired, and since the optical path length is still shorter, the LED printer equipped with such an LED array printer head can be miniaturized. Moreover, since the LED array is produced by the semiconductor manufacturing technology with a mass-production actual result, it can expect low-cost-ization by mass-production-izing. [0003] At the LED printer indicated in the aforementioned reference, the printing process is advanced in the following sequence. First, an electrification machine is used for a photoconductor drum and a uniform charge is given. Next, a photoconductor drum side is made to carry out image formation of the light from an LED array through a convergence nature rod-lens array, and a latent image is formed. Subsequently, you imprint [which was used as the visible image with the developing machine] on the recording paper after that, and make it established. Furthermore, cleaning of a remains toner and electric discharge of a rest potential are performed, and a printing process is ended. In addition, what has a sensitivity property suitable for the luminescence wavelength of Light Emitting Diode also about a photoconductor drum is developed.

[0004] Moreover, the LED array printer head equipped with the LED array in this LED printer has the substrate which formed the thick-film pattern in the ceramic substrate of an alumina, arranges a Light Emitting Diode chip in on a straight line in the center section of this substrate, carries out die bond of the IC chip to the both sides with a conductive paste, and performs electrical installation with wire bond. A signal and a power supply are supplied to a ceramic substrate through a FPC (flexible printed circuit board) substrate. Moreover, it is decided by cutting precision of a chip whether a Light Emitting Diode chip will be continuously connectable.

[0005] By the way, three properties are demanded of the material of Light Emitting Diode.


a) It is three, that isolation of light is made, that the diffusion process in which b densification is possible can be used, and acquiring [the property stabilized at a c economical price] **, and now is taken by that GaAsP which carried out the vapor growth is the optimal on a GaAs substrate as what fills such a demand.

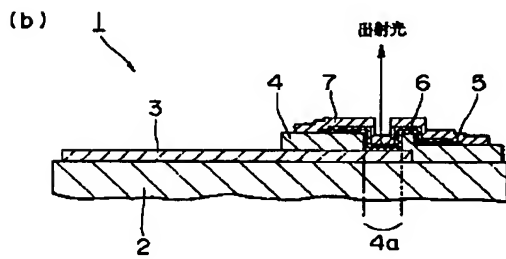
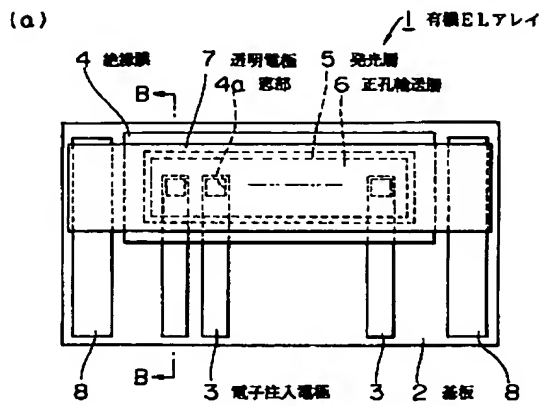
[0006] In order to manufacture such a Light Emitting Diode, a diffusion prevention film is formed in an n type GaAsP wafer by CVD etc., and a luminescence aperture is opened in this by the photolithography method. Next, vacuum enclosure of a wafer and the P type impurity is carried out at quartz ampul, diffusion is performed at the temperature of about 700 degrees C for several hours, and a PN junction is formed in a luminescence aperture. At this time, 5-7 micrometers is suitable as the diffusion depth.

[0007] Subsequently, aluminum is turned on the P side, the vacuum evaporation of the Au alloy is carried out to the N side, respectively, and an ohmic electrode is formed. A light-emitting part size is decided in general by density (resolution), and is set to 40 micrometers by mm in 16 dots (pitch 62.5micrometer) /with it. The number of dots per one chip has 64 dots or 128 practical dots by the chip yield and the size. Luminescence wavelength is decided by material and set to 660nm in this example.

[0008] In the present condition, from level [**10% of] to **40% is contained in 1 wafer, the quantity of light variation in 1 chip is sorted out by prober inspection, and **20% or less of thing is used. The cutting precision of a Light Emitting Diode chip influences array precision, and less than **5-micrometer highly precise cutting technology is needed. The scribe method using the cleavage is used about cutting for this connection.

[Translation done.]

Drawing selection [R pr sentativ drawing] 



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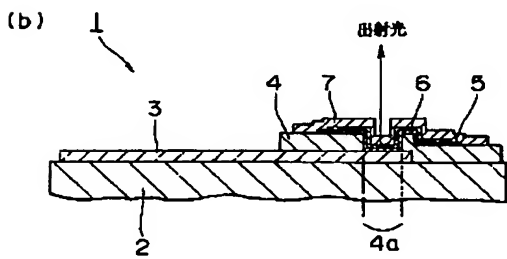
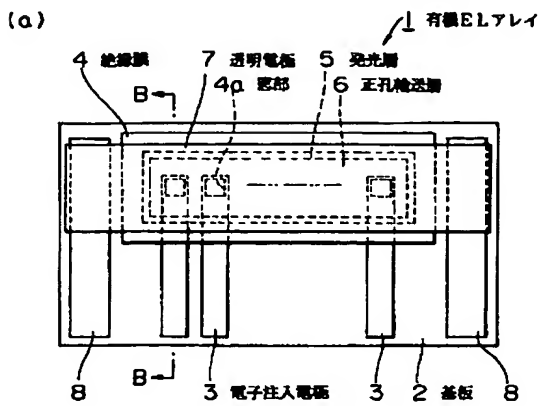
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EFFECT OF THE INVENTION

[Effect of the Invention] As explained above, since organic EL array of this invention can be put in block on an insulating substrate and can be produced, like the conventional LED array, it can avoid the difficulty on mounting of making much Light Emitting Diode chips arrange on a straight line, and, thereby, can attain low-cost-ization. Moreover, it is since it considered as the structure which takes out light from the side which formed the window part of an insulator layer, i.e., the upper surface of an insulating substrate. For example, since loss of the light by the total reflection in a glass rear face which happens when taking out light from the rear face of the substrate which consists of glass, and loss of the light by the absorption to glass can be abolished, light can be taken out outside efficiently and a strong light can be taken out by this in a short time, improvement in the speed of printing by the printer can be enabled.

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Drawing selection [Representative drawing]



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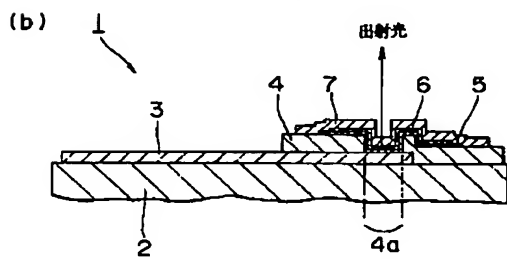
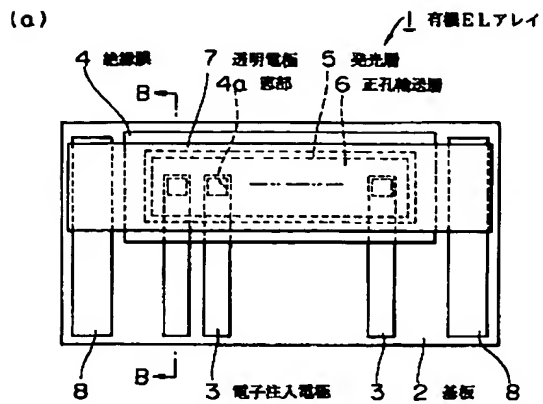
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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] However, in the above-mentioned LED array print head, there is un-arranging [which is described below about the LED array]. Dispersion in the performance between the elements resulting from the defect which is inherent in a wafer, the heterogeneity of a manufacturing process, etc. is unescapable. Now substrates, such as GaAs used as the substrate of an LED array, can produce only a thing with a size of about at most 3 inches, but, moreover, are expensive. Furthermore, the yield will become bad, if there are many defects of a crystal and they make [many] the number of dots with a monolithic type. [0010] Then, although much array chips of the few number of dots are made, these are connected and it is made to cover all recording widths, an array error arises in a chip connection in that case, and it will become it is large and difficult [mounting to a bird clapper etc. and a substrate / from] very much / this array error / as it becomes high-density. The difficulty on such mounting is the big factor which spoils low-cost-izing and densification. The place which this invention was made in view of the aforementioned situation, and is made into the purpose avoids the difficulty on mounting, and is to offer organic EL array which can attain low-cost-izing and densification.

[Translation done.]

Drawing selection [R presentative drawing] 



第1の実施形態例の概略構成図

[Translation done.]

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JAPANESE

[JP,10-055890,A]

CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD PRIOR ART EFFECT OF THE
INVENTION TECHNICAL PROBLEM MEANS DESCRIPTION OF DRAWINGS DRAWINGS

[Translation done.]

*** NOTICES ***

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MEANS

[Means for Solving the Problem] The electron-injection electrode of the number of luminescence dots, and the abbreviation same number formed on the insulating substrate and this insulating substrate in organic EL array of this invention, An insulator layer with the window part used as the luminescence dot which a part of each of these electron-injections electrode is covered, and it is formed on the aforementioned insulating substrate, and carries out opening in each right above section of this electron-injection electrode, The luminous layer formed in contact with each of an electron-injection electrode which covers the aforementioned window part and faces outside from the inside of this window part, It made into the solution means of the aforementioned technical problem to have had the transparent electrode which covered the electron hole transporting bed which covered the right above position of the aforementioned window part, and was formed in contact with this on the aforementioned luminous layer, and this electron hole transporting bed and the aforementioned luminous layer, and was formed on the aforementioned insulating substrate in contact with this electron hole transporting bed.

[0012] Since it is collectively produced on the insulating substrate in which things made long and slender, such as glass, are possible according to this organic EL array, the difficulty on mounting of making much Light Emitting Diode chips arrange on a straight line is avoided like the conventional LED array. Moreover, it becomes possible to abolish loss of the light by the total reflection in a glass rear face which happens when taking out light from the rear face of the substrate which consists of glass, for example, since it considered as the structure which takes out light from the side which formed the window part of an insulator layer, i.e., the upper surface of an insulating substrate, and loss of the light by the absorption to glass, and to take out light outside efficiently.

[0013]

[Embodiments of the Invention] Hereafter, the example of an operation gestalt explains organic EL array of this invention in detail. Drawing 1 (a) and (b) are drawings showing the 1st example of an operation gestalt of this invention, and a sign 1 is organic EL array used as the light source of a print head in these drawings. This organic EL array 1 has many numbers of luminescence dots, with the insulation which consists of glass, on the substrate 2 of a rectangle tabular, is equipped with an insulator layer 4, a luminous layer 5, the electron hole transporting bed 6, and a transparent electrode 7, and is formed with two or more electron-injection electrode 3 --.

[0014] Electron-injection electrode 3 -- is a plane view rectangle-like thing, as shown in drawing 1 (a), is formed on the part substrate 2 of the number corresponding to the number of luminescence dots, and changes parallel into the state where set the predetermined interval, respectively and it was suitable in the direction of a shorter side of a substrate 2. As these electron-injections electrode 3 --, the low thing of a work function is desirable, it is specifically made suitable [a MgAg alloy, In, a MgIn alloy, a MgCu alloy, a MgLi alloy, etc.] so that easily [the electron injection to a luminous layer 5], in this example, a MgAg alloy is used and this is

formed in 200nm in thickness.

[0015] Moreover, on the aforementioned substrate 2, a part of each aforementioned electron-injection electrode 3 -- is covered, and the insulator layer 4 is formed. Window part 4a which carries out opening to the shape of a plane view square in each right above section of aforementioned electron-injection electrode 3 -- is formed in this insulator layer 4. Window part 4a becomes a luminescence dot, and organic EL array becomes a thing with many luminescence dots by forming this window part 4a every electron-injection electrode 3. In addition, the reason which needs this insulator layer 4 is as follows.

[0016] Since a luminous layer 5 and the electron hole transporting bed 6 are organic films as mentioned later, the process of patterning using the photolithography method cannot be borne, therefore this patterning cannot be performed. The field where a deer is carried out and the electron-injection electrode 3 and the luminous layer 5 formed on an insulator layer 4 touch must form the area correctly, when specifying the field where luminescence occurs. Then, after forming the electron-injection electrode 3, form the insulator layer 4 in which exact patterning is possible between this electron-injection electrode 3 and the luminous layer 5 formed in behind, and this is made to be placed between them. And by joining the electron-injection electrode 3 and a luminous layer 5 through window part 4a formed in the insulator layer 4 By performing correctly patterning of window part 4a of this insulator layer 4 can prescribe correctly the area of the field where the electron-injection electrode 3 and a luminous layer 5 touch, i.e., the field where luminescence occurs. It is desirable to form for such a reason from the material which can attain the fine patternizing by the photolithography method as an insulator layer 4, and it is SiNx at this example. A film and SiOx A film etc. is used and this is formed in 300nm in thickness.

[0017] Moreover, on this insulator layer 4, the window part 4a is covered and the luminous layer 5 is formed. As this luminous layer 5 was mentioned above, it was formed in contact with each and electron-injection electrode 3 -- which faces outside from the inside of window part 4a of an insulator 4 consists of an organic film. It is also effective it to be desirable for the electron affinity to be 2.5eV or more, and it to specifically be supposed as this luminous layer 5, for that a metal chelate compound, polycyclic condensation or a conjugate aromatic hydrocarbon, benzoxazole or a benzothiazole derivative, a perylene system compound, a coumarin system compound, etc. are suitable so that an electron may be easy to be poured in, and to dope fluorescence nature coloring matter, such as a pyran derivative, a coumarin derivative, a cyanine derivative, and a Quinacridone derivative, for wavelength control of luminescence or Moreover, the ionization potential of a luminous layer 5 must be lower than that of the electron hole transporting bed 6 so that the hole injection from the electron hole transporting bed 6 mentioned later to a luminous layer 5 may become easy. And based on such conditions, this is formed in 50nm in thickness with the vacuum deposition by resistance heating by this example, using an eight-quinolinol aluminum complex (Alq3) as a luminous layer 5. In addition, the mask vacuum evaporation to which the vacuum evaporation only of the field to form in is carried out as this vacuum deposition was adopted.

[0018] On this luminous layer 5, the right above position of window part 4a of an insulator layer 4 is covered, and the electron hole transporting bed 6 is formed. As this electron hole transporting bed 6, ionization potential needs to be a thing with the electron-donative low molecule or the substituent, and it needs to be transparent to luminescence wavelength, and is specifically a triphenylamine derivative, and a benzidine type, a styryl amine type, a diamine type, etc. are made suitable. And in this example, a diamine derivative (TPD) is used and it is formed in 50nm in thickness by the vacuum deposition by resistance heating like the aforementioned luminous layer 5.

[0019] Moreover, on the aforementioned substrate 2, the electron hole transporting bed 6 and a luminous layer 5 are covered, and the transparent electrode 7 is formed in contact with the electron hole transporting bed 5. This transparent electrode 7 consists of what has permeability

to a translucency, i.e., luminescence wavelength, and in order that it may make easy pouring of the electron hole to the electron hole transporting bed 6 which is an organic film so that it may mention later and, it is desirable that a work function is a large conductor, and it is formed in 150nm in thickness of the indium-stannic-acid ghost (ITO) in this example. Moreover, this transparent electrode 7 covers the electron hole transporting bed 6 and a luminous layer 5, and since the electron hole transporting bed 6 and a luminous layer 5 are organic films, is formed for preventing degradation by air contact of these organic film.

[0020] This transparent electrode 7 is electrically connected with the common electrode 8 arranged at the both sides of a substrate 2 as shown in drawing 1 (a). This common electrode 8 is formed simultaneously with the electron-injection electrode 3. And the organic EL array 1 is what sandwiched the luminous layer 5 and the electron hole transporting bed 6 between each electron-injection electrodes 3 and transparent electrodes 7 in the portion of window part 4a of an insulator layer 4 at the basis of such composition.

[0021] Next, the organic EL array 1 of such composition is explained with reference to drawing 2 about the example at the time of applying to a print head. In drawing 2, a sign 1 is organic EL array shown in drawing 1 (a) and (b), and the substrate 2 of this organic EL array 1 is mounted on the drive circuit board 9 with the driver IC 10. As for the drive circuit board 9 and the driver IC 10, electrical installation is made by the bonding wire 11. Similarly, electrical installation is made by the bonding wire 11, respectively also about the substrate 2 of a driver IC 10 and the organic EL array 1 and the substrate 2 of the organic EL array 1, and the drive circuit board 9.

[0022] The convergence nature rod-lens array 12 and the photoconductor drum 13 are arranged in the upper part [of the organic EL array 1], i.e., the upper surface of substrate 2 of organic EL array 1, side by this order. And outgoing radiation of the light emitted from the organic EL array 1 on the basis of such composition is carried out to the upper surface side of a substrate 2, and it is condensed by the photoconductor drum 13 through the convergence nature rod-lens array 12.

[0023] Next, based on the composition of a print head shown in drawing 2, operation of the organic EL array 1 shown in drawing 1 (a) and (b) is explained. First, in drawing 2, the data of a content to print are sent to the driver IC 10 on the drive circuit board 9. Then, in the organic EL array 1 shown in drawing 1 (a) and (b), voltage is impressed so that data may become the electron-injection electrode 3 with a negative potential at the dot (window part 4a) of "ON", in view of the common electrode 8. Here, "ON" and "OFF" are decided by existence of generating of the voltage difference between the electron-injection electrodes 3 and the common electrodes 8 by switch of two level of the applied voltage to the electron-injection electrode 3 set up beforehand.

[0024] In "ON", it operates as follows. Supply current is supplied to the common electrode 8 through a bonding wire 11, and flows to a transparent electrode 7 further. Consequently, the hole injection into the electron hole transporting bed 6 happens. On the other hand, the electron injection to a luminous layer 5 is similarly generated by the electron-injection electrode 3. The movement is blocked by the difference of the electron affinity of a luminous layer 5 and the electron hole transporting bed 6, when the electron poured into the luminous layer 5 moves toward the electron hole transporting bed 6 in the inside of a luminous layer 5 and an interface with the electron hole transporting bed 6 is arrived at.

[0025] However, if the electron hole poured into the electron hole transporting bed 6 moves toward the luminous layer 5 in the inside of the electron hole transporting bed 6 and arrives at an interface with a luminous layer 5, it is easily poured in into this luminous layer 5, and is recombined with the electron which was standing by there. And the excitation of an eight-quinolinol aluminum complex (Alq3) in which this recombination energy forms a luminous layer 8 is caused, and further, when returning from this excitation state to a ground state, fluorescence with a luminescence wavelength of 540nm is emitted.

[0026] The light by the side of a transparent electrode 7 penetrates a transparent electrode 7

as it is among the light generated by such mechanism, on the other hand, the light by the side of the electron-injection electrode 3 is reflected by this electron-injection electrode 3, and both are taken out by the upper surface shell exterior of a substrate. And as shown in drawing 2, through the convergence nature rod-lens array 12, the light taken out by this exterior condenses to a photoconductor drum 13, and carries out required time irradiation. The point operates like the usual electrophotography method printer from here. In addition, since the potential difference does not have data between a transparent electrode 7 and the electron-injection electrode 3 at the dot (window part 4a) of "OFF", current does not flow and, thereby, luminescence does not take place by this dot.

[0027] Therefore, if it is in such an organic EL array 1, since it can produce collectively on one substrate 2, like the conventional LED array, the difficulty on mounting of making much Light Emitting Diode chips arrange on a straight line can be avoided, and low-cost-ization can be attained. Moreover, since it considered as the structure which takes out light from the upper surface side of a substrate 2, and loss of the light by the total reflection in a glass rear face which happens when taking out light from the rear face of the substrate which consists of glass, for example, and loss of the light by the absorption to glass can be abolished, light can be taken out outside efficiently and a strong light can be taken out by this in a short time, improvement in the speed of printing by the printer can be enabled.

[0028] Drawing 3 (a) and (b) are drawings showing the 2nd example of an operation gestalt of this invention, and a sign 20 is organic EL array in these drawings. The place where this organic EL array 20 differs from the organic EL array 1 shown in drawing 1 (a) and (b) is the point that crevice 21a to which the thickness becomes thin gradually the shape of the said heart toward the center of window part 4a of an insulator layer 4 at the electron-injection electrode 21 is prepared.

[0029] That is, crevice 21a stair-like into the portion located in window part 4a of an insulator layer 4 is formed in the electron-injection electrode 21 of the organic EL array 20 in this example of an operation form. This crevice 21a was taken toward the center of window part 4a of an insulator layer 4, the thickness of the electron-injection electrode 21 was thinly formed of the bird clapper stair-like gradually, and a plane view square-like crevice is dented and formed in two stages in this example, and the depression of these 2 stage is formed in the shape of the said heart to the center of window part 4a. Here, the reason which can dent crevice 21a in the shape of the said heart is for making it a direction dependency not appear in the outgoing radiation intensity of light.

[0030] Moreover, in this crevice 21a, the field of the shape of drawing 3 (a) and a plane view square shown in [P] (b) serves as a portion which is a core and was formed most thinly, and the field of the shape of the field of the outside of this P field, i.e., drawing 3, (a), and a plane view square frame shown in [Q] (b) serves as a portion formed thinly next. In this example of an operation gestalt, thickness of the field shown by P which is the thinnest portion of a core was set to 100nm, and the level difference per step of the stairway in crevice 21a was set to 1 micrometer. Therefore, the thickness of the thickest portion of the electron-injection electrode 21 is set to 2.1 micrometers, and the thickness of the field shown by Q is set to 1.1 micrometers. In addition, about the configuration of such stair-like crevice 21a, since it is easily processible conventionally with a phot well-known lithography technology and etching technology, the explanation is omitted here.

[0031] After forming the electron-injection electrode 21 naturally and forming crevice 21a by ETCHIGGU further in manufacture of the organic EL array 20 with such an electron-injection electrode 21, formation of an insulator layer 4 and processing of the window part 4a are performed. And although a luminous layer 5, the electron hole transporting bed 6, and a transparent electrode 7 are formed one by one on it, since window part 4a of an insulator layer 4 is formed so that the aforementioned crevice 21a may be located in the interior, this crevice 21a will be exposed outside (upper surface side) within window part 4a. Therefore, by forming a

luminous layer 5 in contact with this crevice 21a, as shown in drawing 3 (b), a stair-like crevice is seemingly formed also in this. Furthermore, an apparent stair-like crevice is similarly formed in the electron hole transporting bed 6 and a transparent electrode 7.

[0032] Thus, by forming crevice 21a in the electron-injection electrode 21, by the usual manufacture method, the rest is seen also in a luminous layer 5, the electron hole diffusion layer 6, and a transparent electrode 7, and can form the upper crevice. Therefore, compared with the thing of the 1st example of an operation gestalt, the surface area itself is large, from a bird clapper, the luminescence area also becomes large and, naturally, thereby, the luminous layer 5 especially formed in window part 4a of an insulator layer 4 can increase the total amount of the outgoing radiation light around unit time. And the total amount of the light which condenses to a photoconductor drum 13 through the convergence nature rod-lens array 12 as shown in drawing 2 can be increased by the ability increasing the total amount of outgoing radiation light in this way. That is, the total amount of the light around [which is condensed by the photoconductor drum 13] unit time can be increased by enlarging luminescence area.

[0033] This means that the luminescence time for performing printing for which it asks so that it may mention later can be shortened in printer head composition as shown in drawing 3.

However, you have to enlarge luminescence area, without enlarging window part 4a of an insulator layer 4 in enlarging luminescence area. because, window part 4a of an insulator layer 4 -- extending (it enlarging) -- it is because fixing of a toner will lap with the next dot and a quality of printed character will be spoiled, if the phenomenon separation of light becomes impossible between adjacent dots (window parts 4a and 4a) happens and such a phenomenon happens

[0034] In the organic EL array 20 of this example of an operation gestalt, without extending window part 4a of an insulator layer 4 by having formed crevice 21a in the electron-injection electrode 21, as mentioned above, it has structure which enlarged luminescence area, therefore can avoid un-arranging [that the aforementioned quality of printed character is spoiled]. The result which asked below for the ability of the organic EL array 20 of this example of an operation gestalt to shorten [how much luminescence time] by calculation is shown.

[0035] Total amount P_t of one luminescence dot (organic [EL]), i.e., the outgoing radiation light around unit time from one window part 4a, It is proportional to the luminescence area A . It is as follows when this is expressed with a formula.

$$P_t = a \times A \quad \text{-- (1)}$$

Here, a is the total amount of unit time and the outgoing radiation light per unit area, and is decided by the property organic [EL].

[0036] By the way, in the light source in the optical printer of an electrophotography method especially an LED array, or organic EL array of this invention, if the density of a luminescence dot is decided, the size of these luminescence dot and area will be decided almost automatically. It is because the phenomenon exposed to the next dot occurs if too small and it is [the amount of light itself decreases and] too large. Then, the area of the luminescence dot formed with the optimal size is fixed as S . This S corresponds to the area of window part 4a of an insulator layer 4 in this example of an operation form. And it is P_s about the total amount of the outgoing radiation light around [which can be taken out from this S] unit time. If it carries out, since luminescence area can be increased in fixed S in this example of an operation form, if the increment of the luminescence area by formation of crevice 21a is set to α , it is P_s about the total amount of outgoing radiation light. It can express as follows.

$$P_s = a \times (S + \alpha) \quad \text{-- (2)}$$

[0037] Total amount P_s of the outgoing radiation light around [which is emitted from window part 4a of an insulator layer 4] unit time Inside, The total amount around [which the convergence nature rod-lens array 12 shown in drawing 2 is penetrated, and is further irradiated by the photoconductor drum 13] photometric-units time (luminescence power is called hereafter.) PD When efficiency in consideration of the probability which can carry out incidence

to the convergence nature rod-lens array 12, the probability which can penetrate the convergence nature rod-lens array 12 is set to η , it can express with the following formulas.

$$PD = P_s \eta \quad \text{--- (3)}$$

Furthermore, it is as follows if a formula (2) is substituted for a formula (3).

$$PD = a x (S + \alpha) \eta \quad \text{--- (4)}$$

[0038] Next, when luminescence time is set to T , the total amount E of the light which contributes to exposure, i.e., exposure energy, can be expressed with the following formulas.

$$E = PD \times T \quad \text{--- (5)}$$

It is as follows if a formula (3) is substituted for a formula (5).

$$E = P_s \times \eta \times T \quad \text{--- (6)}$$

It is as follows if a formula (2) is substituted for a formula (6).

$$E = a x (S + \alpha) \times \eta \times T \quad \text{--- (7)}$$

If this is expressed about T , it will become the following.

$$T = E / \{a \eta x (S + \alpha)\} \quad \text{--- (8)}$$

Moreover, since the total amount E of the light which contributes to exposure, i.e., exposure energy, is fixed, it is as follows.

$$T = K / (S + \alpha) \quad \text{--- (9)}$$

Here, $K = E / \{a \eta x\}$ is a constant.

[0039] Next, luminescence time explains concretely which was shortened by this example of an operation gestalt using a numeric value. A length of one sides of P [in /

$S = 15 \text{ micrometer} \times 15 \text{ micrometer} = 225 \text{ micrometer}^2$ and drawing 3 (b) / for the area (S) of window part 4a of an insulator layer 4] and Q was set to 5 micrometers and 10 micrometers. Therefore, the area (α) which increased by crevice 21a is set to $\alpha = 1 \text{ micrometer (level difference)} \times 10 \text{ micrometer (one-side length)} \times 4 \text{ (number of neighboring)} + 1 \text{ micrometer (level difference)} \times 5 \text{ micrometer (one-side length)} \times 4 \text{ (number of neighboring)} = 60 \text{ micrometer}^2$.

[0040] Therefore, it is set to $(S + \alpha) / S = 1.27$, and luminescence area becomes the increase of 27%. In addition, according to survey, it is the actual luminescence power PD . It was increasing about 50%. That is, it is actual PD although only an area increment increases due to a formula (4). It becomes large more than it is expressed with a formula (4). For the luminescence time T , this is not the formula (9) showing only the area effect but the actual luminescence power PD . It is thought that it is because a formula (5) is followed since it is determined.

[0041] Thus, if it was in the organic EL array 20 of this example of an operation gestalt, since crevice 21a was formed in the electron-injection electrode 3, compared with the case where this is not formed, luminescence power can be increased 1.5 times, and, thereby, luminescence time can be shortened to 3 by about 2/. and luminescence time --- about --- it can be made two thirds --- time required for printing per line --- about --- the printing speed which it can be shortened to two thirds, therefore can be printed to around unit time can be increased about 1.5 times That is, in this example of an operation gestalt, printing speed can be directly made quick only by configuration processing of the electron-injection electrode 3. In addition, in this invention, if it is the configuration to which the thickness of the electron-injection electrode 3 becomes thin gradually the shape of the said heart toward the center of window part 4a of an insulator layer 4, without being limited to the configuration shown in drawing 3 (a) and (b) about the configuration of a crevice, of course, the configuration which has three or more steps of level differences, for example, the configuration gradually dented in the shape of a taper are sufficient.

[0042] Drawing 4 (a) and (b) are drawings showing the 3rd example of an operation gestalt of this invention, and a sign 30 is organic EL array in these drawings. The place where this organic EL array 30 differs from the organic EL array 1 shown in drawing 1 (a) and (b) is the point that four thin part 31a with thin thickness is formed in the electron-injection electrode 31 compared with other parts. That is, four thin part 31a is formed in the portion located in window part 4a of an insulator layer 4 at the electron-injection electrode 31 of the organic EL array 30 in this

example of an operation gestalt. Thin part 31a is a plane view square-like thing, and as shown in drawing 4 (a), it is equally arranged from the center of this window part 4a at the four-corners section of window part 4a. Here, the reason which has arranged four thin part 31a equally from a center in this way is for making it a direction dependency not appear in the outgoing radiation intensity of light like the case of the 2nd example of an operation gestalt.

[0043] As for thin part 31a, the thickness is set to 100nm in the electron-injection electrode 3, and the level difference with other parts of the electron-injection electrode 3 is set to 1 micrometer. Namely, as for the electron-injection electrode 3, the thickness of parts other than thin part 31a is formed in 1.1 micrometers. In addition, since it is easily processible conventionally also about such thin part 31a with a phot well-known lithography technology and etching technology, the explanation is omitted.

[0044] Moreover, after forming the electron-injection electrode 21 naturally and forming crevice 21a by ETCHIGGU further in manufacture of the organic EL array 20 with such an electron-injection electrode 21, formation of an insulator layer 4 and processing of the window part 4a are performed. And although a luminous layer 5, the electron hole transporting bed 6, and a transparent electrode 7 are formed one by one on it, since window part 4a of an insulator layer 4 is formed so that the aforementioned crevice 21a may be located in the interior, this crevice 21a will be exposed outside (upper surface side) within window part 4a. Therefore, a luminous layer 5 is seen also in this, as by being formed in contact with this crevice 21a showed to drawing 3 (b), and the upper crevice is formed. Furthermore, an apparent crevice is similarly formed in the electron hole transporting bed 6 and a transparent electrode 7.

[0045] Moreover, like the example of an operation form of the above 2nd, by forming thin part 31a-- in the electron-injection electrode 21 in this way, the rest is seen also in a luminous layer 5, the electron hole diffusion layer 6, and a transparent electrode 7, and can form the upper crevice by the usual manufacture method. Therefore, even if it is in this 3rd example of an operation form, compared with the thing of the 1st example of an operation form, the surface area itself is large, from a bird clapper, the luminescence area also becomes large and, naturally, thereby, the luminous layer 5 especially formed in window part 4a of an insulator layer 4 can increase the total amount of the outgoing radiation light around unit time. And even if it is in this 2nd example of operation form organic EL array 30 by the ability increasing the total amount of outgoing radiation light in this way, as mentioned above, the total amount of the light which condenses to a photoconductor drum 13 through the convergence nature rod-lens array 12 in the composition of drawing 2 can be increased, and the total amount of the light around [which is condensed by the photoconductor drum 13 by this] unit time can be increased.

[0046] The result which asked below for the ability of the organic EL array 30 of this example of an operation form to shorten [how much luminescence time] concretely by calculation using the numeric value like the case of the 2nd example of an operation form is shown. A length [in / the plane view configuration of $S=15\text{micrometer} \times 15\text{micrometer}=225\text{micrometer}^2$ and thin part 31a / for the area (S) of window part 4a of an insulator layer 4] of one side was set to 5 micrometers. Therefore, area which increased by four thin part 31a (alpha)

$$\alpha=1\text{micrometer}(\text{level difference}) \times 5\text{micrometer}(\text{one-side length}) \times 4(\text{number of neighboring}) \times 4(\text{the number of thin parts})$$

= 80micrometer^2 It becomes. Therefore, it is set to $(S+\alpha) / S= 1.36$, and luminescence area becomes the increase of 36%. In addition, according to survey, it is the actual luminescence power PD. It was increasing about 70%. This is considered because the same effect as the case of the 2nd example of an operation form has occurred.

[0047] Thus, if it was in the organic EL array 30 of this example of an operation form, since thin part 31a-- was formed in the electron-injection electrode 3, compared with the case where this is not formed, luminescence power can be increased 1.7 times, and, thereby, luminescence time can be shortened to 5 by about 3/. and luminescence time -- about -- it can be made three fifths -- time required for printing per line -- about -- the printing speed which it can be

shortened to three fifths, therefor can be printed to around unit time can be increased about 1.7 times That is, in this example of an operation form, only by configuration processing of the electron-injection electrode 3, since printing speed can be directly made quick and four thin part 31a-- can moreover be once formed at an etching process, a process can be simplified and, thereby, low-cost-ization can also be attained. in addition, without it being alike and being limited to four about the number of thin part 31a, it is plurality, and if a manufacture top is possible, it is good in this invention, without limit

[0048] Drawing 5 (a) and (b) are drawings showing the 4th example of an operation form of this invention, and a sign 40 is organic EL array in these drawings. The place where this organic EL array 40 differs from the organic EL array 1 shown in drawing 1 (a) and (b) is the point that the 2nd insulator layer 41 is formed between a substrate 2 and the electron-injection electrode 3, and crevice 41a to which the thickness becomes thin stair-like gradually toward the center of window part 4a of an insulator layer 4 at this 2nd insulator layer 41 is prepared.

[0049] That is, formation of the electron-injection electrode 3 is preceded in the organic EL array 40 in this example of an operation form, and it is SiNX on a substrate 2. A film and SiOX The 2nd insulator layer 41 which consists of a film is formed. Crevice 41a of the same configuration as crevice 21a formed in the electron-injection electrode 21 in the 2nd example of an operation form is formed in this 2nd insulator layer 41. That is, this crevice 41a was also taken toward the center of window part 4a of an insulator layer 4 like the aforementioned crevice 21a, the thickness of the 2nd insulator layer 41 was thinly formed of the bird clapper stair-like gradually, and a plane view square-like crevice is dented and formed in two stages, and the depression of these 2 stage is formed in the shape of the said heart to the center of window part 4a. And the electron-injection electrode 3 is the thing of a configuration in alignment with the configuration of this crevice 41a by being formed on the 2nd insulator layer 41 in which such crevice 41a was formed.

[0050] In addition, also in this crevice 41a, the field of the shape of drawing 5 (a) and a plane view square shown in [P] (b) serves as a portion which is a core and was formed most thinly, and the field of the shape of the field of the outside of this P field, i.e., drawing 5 , (a), and a plane view square frame shown in [Q] (b) serves as a portion formed thinly next. And in this example of an operation form, thickness of the field shown by P was set to 100nm like crevice 21a in the 2nd example of an operation form, and the level difference per step of the stairway in crevice 41a was set to 1 micrometer. Therefore, the thickness of the thickest portion of the 2nd insulator layer 41 is set to 2.1 micrometers, and the thickness of the field shown by Q is set to 1.1 micrometers. About the configuration of such stair-like crevice 41a, since it is easily processible conventionally with a phot well-known lithography technology and etching technology, the explanation is omitted. Moreover, the reason which can dent crevice 41a in the shape of the said heart is for making it a direction dependency not appear in the outgoing radiation intensity of light like the 2nd example of an operation form.

[0051] As mentioned above, after forming the 2nd insulator layer 41 and forming crevice 41a by ETCHIGGU further in manufacture of the organic EL array 40 with such 2nd insulator layer 41, formation of the electron-injection electrode 3, formation of an insulator layer 4, and processing of the window part 4a are performed. At this time, as by being formed in contact with this crevice 41a showed the electron-injection electrode 3 to drawing 5 (b), a stair-like crevice is seemingly formed also in this. Subsequently, although a luminous layer 5, the electron hole transporting bed 6, and a transparent electrode 7 are formed one by one on an insulator layer 4, since window part 4a of an insulator layer 4 is formed so that the aforementioned crevice 41a may be located in the interior, the apparent crevice of the electron-injection electrode 3 formed on this crevice 41a will be exposed outside (upper surface side) within window part 4a. Therefore, a respectively apparent stair-like crevice is formed also in a luminous layer 5, the electron hole transporting bed 6, and a transparent electrode 7.

[0052] Thus, by forming crevice 41a in the 2nd insulator layer 41, by the usual manufacture

method, the rest is seen also in the electron-injection electrode 3, a luminous layer 5, the electron hole diffusion layer 6, and a transparent electrode 7, and can form the upper crevice. Therefore, compared with the thing of the 1st example of an operation gestalt, the surface area itself becomes large by the stair-like configuration and bird clapper corresponding to the configuration of crevice 41a in the luminous layer 5 especially formed in window part 4a of an insulator layer 4. Therefore, even if it is in the thing of this example of an operation gestalt, greatly, from the bird clapper, the luminescence area can increase the total amount of the outgoing radiation light around unit time, and, naturally can increase the total amount of the light around [which is condensed by the photoconductor drum 13 in the composition which this showed to drawing 2] unit time.

[0053] In addition, it is easy to crystallize a luminous layer 5 and the electron hole transporting bed 6 in a portion with a level difference, and once it crystallizes these, the crystalline region will spread. And if this trespasses even upon a luminescence field, the portion will become the dark spot which does not emit light, will become what forms a point defect, and will spoil a quality of printed character remarkably. Therefore, as for an unnecessary level difference configuration, not giving as much as possible is desirable. In this example of an operation gestalt, since the shape of toothing is formed only in the window part 4 of an insulator layer with the need of enlarging luminescence area, formation of the point defect accompanying crystallization of a luminous layer 5 or the electron hole transporting bed 6 can be suppressed to the minimum, and improvement in the yield can be aimed at.

[0054] The result which asked below for the ability of the organic EL array 40 of this example of an operation gestalt to shorten [how much luminescence time] concretely by calculation using the numeric value like the case of the 2nd example of an operation gestalt is shown. A length of one sides of P [area / (S) / of window part 4a of an insulator layer 4] in $S = 15$ micrometer $\times 15$ -micrometer = 225-micrometer² and drawing 5 (b) and Q was set to 5 micrometers and 10 micrometers. Therefore, the area (alpha) which increased by crevice 41a is set to $\alpha = 1 \text{ micrometer (level difference)} \times 10 \text{ micrometer (one-side length)} \times 4 \text{ (number of neighboring)} + 1 \text{ micrometer (level difference)} \times 5 \text{ micrometer (one-side length)} \times 4 \text{ (number of neighboring)} = 60 \text{ micrometer}^2$. Therefore, it is set to $(S + \alpha) / S = 1.27$, and luminescence area becomes the increase of 27%. In addition, according to survey, it is the actual luminescence power PD. It was increasing about 50%. This is considered because the same effect as the case of the 2nd example of an operation gestalt has occurred.

[0055] Thus, if it was in the organic EL array 40 of this example of an operation gestalt, since crevice 41a was formed in the 2nd insulator layer 41, compared with the case where this is not formed, luminescence power can be increased 1.5 times, and, thereby, luminescence time can be shortened to 3 by about 2/. and luminescence time -- about -- it can be made two thirds -- time required for printing per line -- about -- the printing speed which it can be shortened to two thirds, therefore can be printed to around unit time can be increased about 1.5 times That is, in this example of an operation gestalt, printing speed can be directly made quick only by configuration processing of the electron-injection electrode 3. In addition, in this invention, if it is the configuration to which the thickness of the 2nd insulator layer 4 becomes thin gradually the shape of the said heart toward the center of window part 4a of an insulator layer 4, without being limited to the configuration shown in drawing 5 (a) and (b) about the configuration of a crevice, of course, the configuration which has three or more steps of level differences, for example, the configuration gradually dented in the shape of a taper are sufficient.

[0056] Drawing 6 (a) and (b) are drawings showing the 5th example of an operation gestalt of this invention, and a sign 50 is organic EL array in these drawings. The place where this organic EL array 50 differs from the organic EL array 1 shown in drawing 1 (a) and (b) the side of the insulator layer 4 which forms each electron-injection electrode 3 and this window part 4a is worn into the portion located in window part 4a of an insulator layer 4, and the 2nd electron-injection electrode 51 prepares in it -- having -- a luminous layer 5 -- this -- it is the

point which covers the 2nd electron-injection electrode 51 and is formed

[0057] Namely, it sets to the organic EL array 50 in this example of an operation gestalt. After forming electron-injection electrode 3 and forming an insulator layer 4 and its window part 4a further, in contact with the side of the insulator layer 4 which covers this in contact with the electron-injection electrode 3, and forms window part 4a, the insulator layer 4 for a periphery of this window part 4a is also covered for this with a wrap, and the 2nd electron-injection electrode 51 is formed. As this 2nd electron-injection electrode 51, the low thing of a work function is desirable, it is specifically made suitable [a MgAg alloy, In, a MgIn alloy, a MgCu alloy, a MgLi alloy, etc.] so that easily [the electron injection to a luminous layer 5], in this example, a MgAg alloy is used and this is formed in 100nm in thickness. However, in this example of an operation gestalt, since it stops being almost related to the electron injection to a luminous layer 5 about the electron-injection electrode 3, a work function does not need to consider as a low thing, therefore aluminum is used.

[0058] If it is in the organic EL array 50 of this example of an operation gestalt Since the side of the insulator layer 4 which forms each electron-injection electrode 3 and this window part 4a for the 2nd electron-injection electrode 51 was worn and formed Also in the window part 4a side of the insulator layer 4 which causes optical leakage in window part 4a especially, by covering this by the 2nd electron-injection electrode 51, it reflects without the generated light leaking on this side, and is taken out as an outgoing radiation light. Consequently, total amount PS of outgoing radiation light It can enlarge.


[0059] The result which asked below for the ability of the organic EL array 50 of this example of an operation form to shorten [how much luminescence time] concretely by calculation using the numeric value like the case of the 2nd example of an operation form is shown. The amount of the light which it is newly reflected by the 2nd electron-injection electrode 51, and can be taken out outside as an outgoing radiation light is equivalent to the following reflector product increase parts beta.

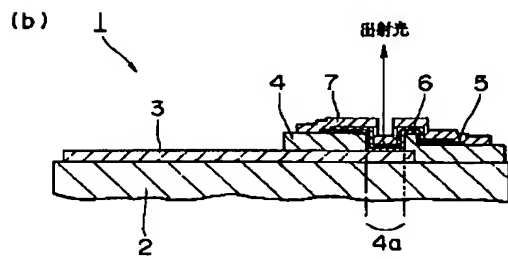
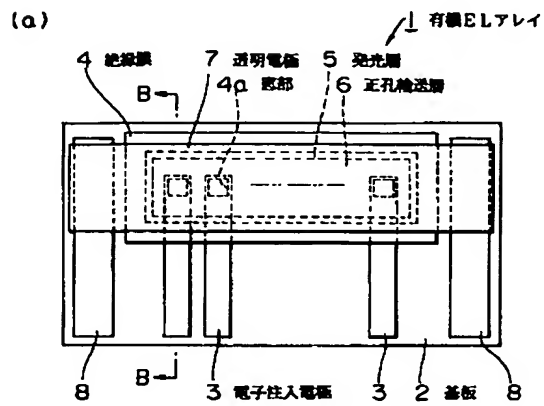
a part for reflector product increase -- $\beta = 0.3 \text{ micrometer (thickness of insulator layer)} \times 15 \text{ micrometer (one-side length of window part)} \times 4 \text{ (number of neighboring)} = 18 \text{ micrometer}^2$ -- here, PD2 is as follows when luminescence power obtained when only beta increases a reflector product is set to PD2

Although $PD2 = PD / (S + \beta)$ $S = 1.08P$ luminescence area does not change, a reflector product becomes the increase of 8%. In addition, according to survey, the actual luminescence power PD 2 was increasing about 20%. here -- it should observe -- it is the point which has not changed luminescence area If luminescence area becomes large, luminescence power will go up, and [instead] you also have to increase supply current. However, luminescence power can be raised in this example of an operation gestalt, without increasing supply current, since luminescence power can be raised without enlarging luminescence area.

[0060] Thus, if it was in the organic EL array 50 of this example of an operation gestalt, since the side of the insulator layer 4 which forms each electron-injection electrode 3 and this window part 4a for the 2nd electron-injection electrode 51 was worn and formed, compared with the case where this is not formed, luminescence power can be increased 1.2 times, and, thereby, luminescence time can be shortened to 5 by about 4/. and luminescence time -- about -- it can be made four fifths -- time required for printing per line -- about -- the printing speed which it can be shortened to four fifths, therefore can be printed to around unit time can be increased about 1.2 times Moreover, since luminescence power can be raised in this example of an operation gestalt, without increasing supply current, luminous efficiency can be improved and, thereby, reduction-ization of the consumed electric current can be attained.

[Translation done.]

Drawing selection [R presentative drawing] 



第1の実施形態例の概略構成図

[Translation done.]

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JAPANESE [JP,10-055890,A]

CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD PRIOR ART EFFECT OF THE
INVENTION TECHNICAL PROBLEM MEANS DESCRIPTION OF DRAWINGS DRAWINGS

[Translation done.]

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2.**** shows the word which can not be translated.

3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] (a) and (b) are drawings showing the outline composition of the 1st example of an operation gestalt of organic EL array in this invention, (a) is a plan and (b) is the B-B line view cross section of (a).

[Drawing 2] It is the outline block diagram of the print head using organic EL array shown in drawing 1.

[Drawing 3] (a) and (b) are drawings showing the outline composition of the 2nd example of an operation gestalt of organic EL array in this invention, (a) is a plan and (b) is the B-B line view cross section of (a).

[Drawing 4] (a) and (b) are drawings showing the outline composition of the 3rd example of an operation gestalt of organic EL array in this invention, (a) is a plan and (b) is the B-B line view cross section of (a).

[Drawing 5] (a), (b), and (c) are drawings showing the outline composition of the 4th example of an operation form of organic EL array in this invention, and (a) is [the B-B line view cross section of (a) and (c of a plan and (b))] the C-C line view cross sections of (a).

[Drawing 6] (a) and (b) are drawings showing the outline composition of the 5th example of an operation gestalt of organic EL array in this invention, (a) is a plan and (b) is the B-B line view cross section of (a).

[Description of Notations]

1, 20, 30, 40, 50 Organic EL array

2 Substrate

3, 21, 31 Electron-injection electrode

4 Insulator Layer

4a Window part

5 Luminous Layer

6 Electron Hole Transporting Bed

7 Transparent Electrode

21a Crevice

31a Thin part

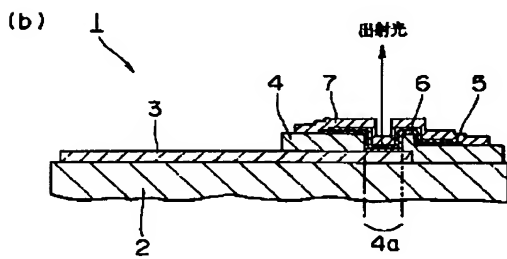
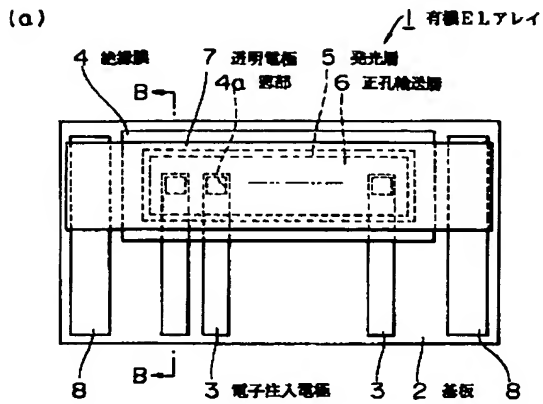
41 2nd Insulator Layer

41a Crevice

51 2nd Electron-Injection Electrode

[Translation done.]

Drawing selection [Representative drawing]



第1の実施形態例の概略構成図

[Translation done.]

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JAPANESE

[JP,10-055890,A]

CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD PRIOR ART EFFECT OF THE
INVENTION TECHNICAL PROBLEM MEANS DESCRIPTION OF DRAWINGS DRAWINGS

[Translation done.]

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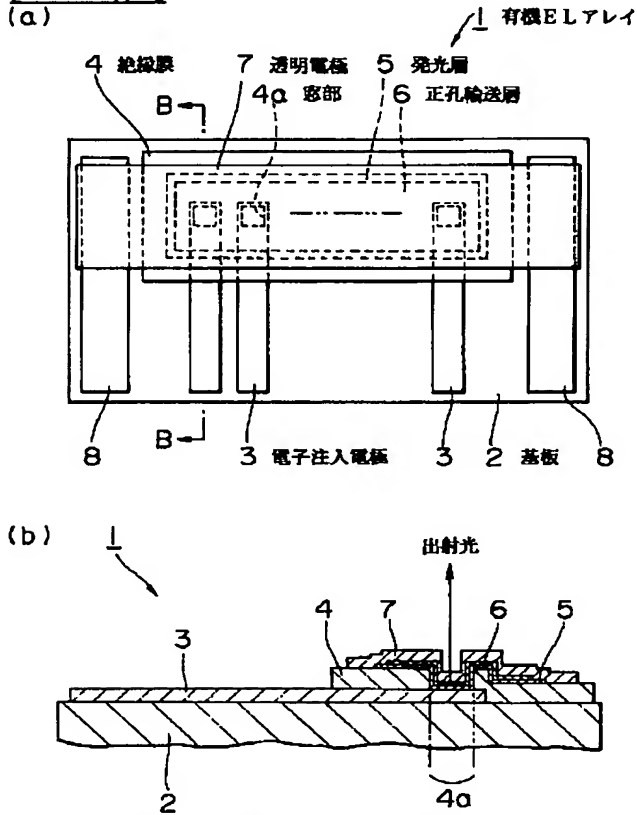
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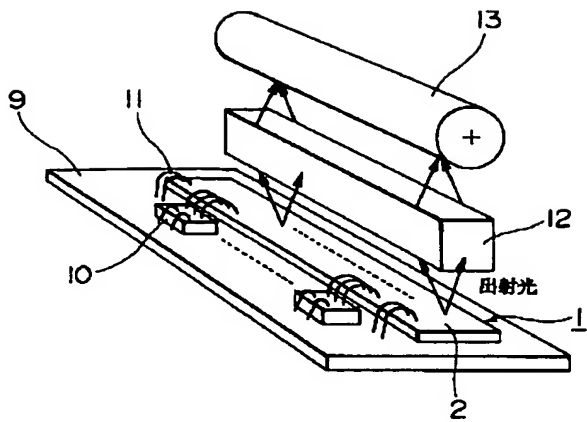
DRAWINGS

[Drawing 1]



第1の実施形態例の概略構成図

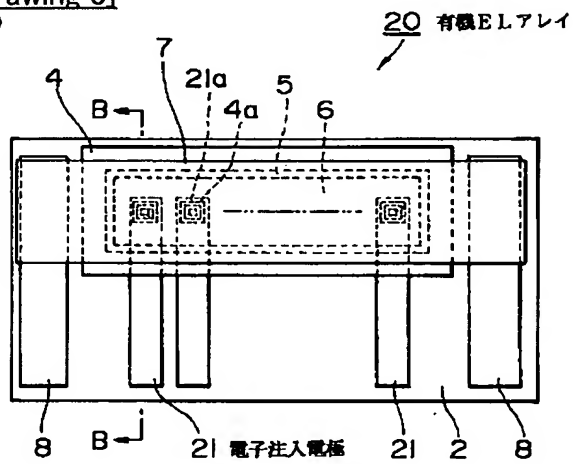
[Drawing 2]



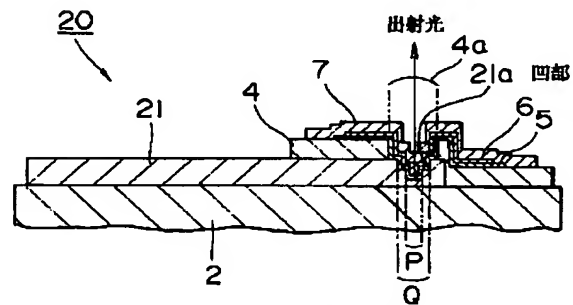
プリントヘッドの概略構成図

[Drawing 3]

(a)

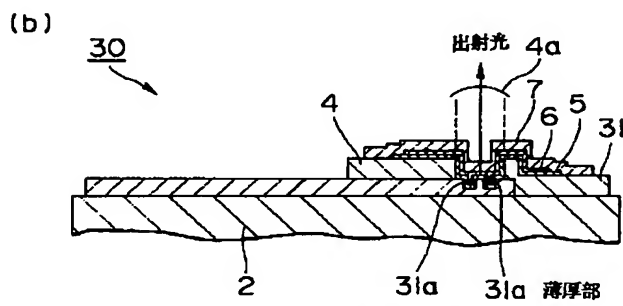
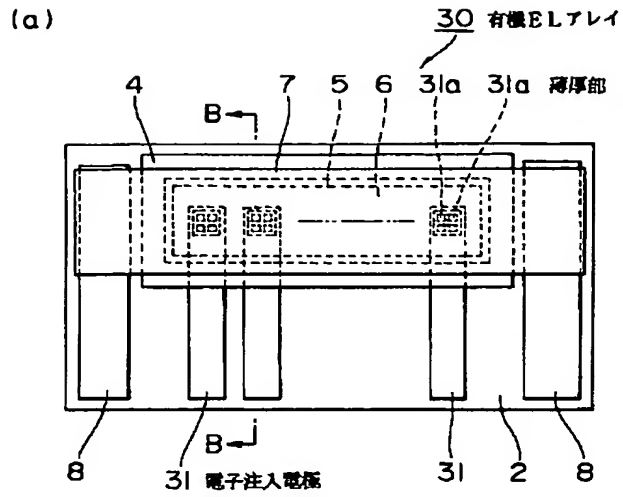


(b)



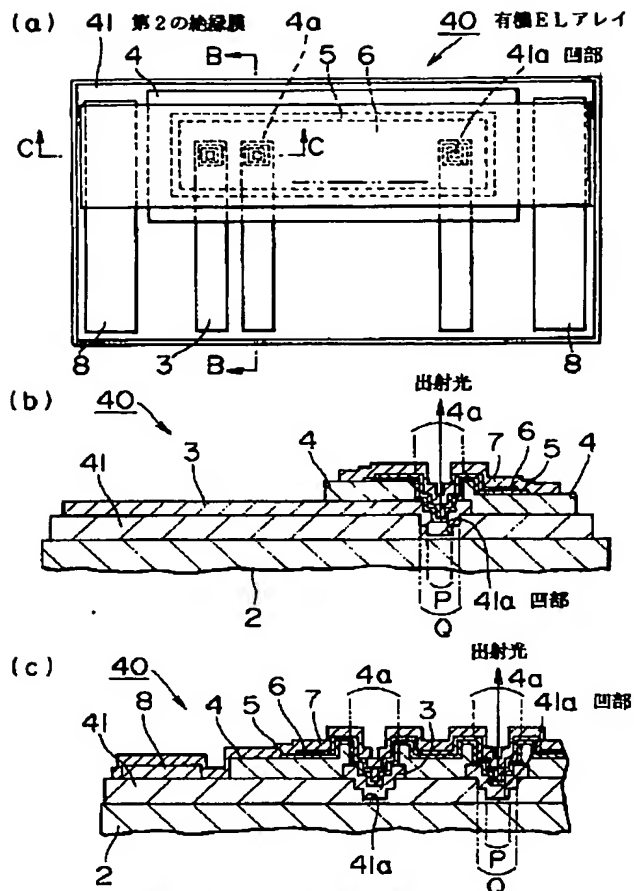
第2の実施形態例の概略構成図

[Drawing 4]



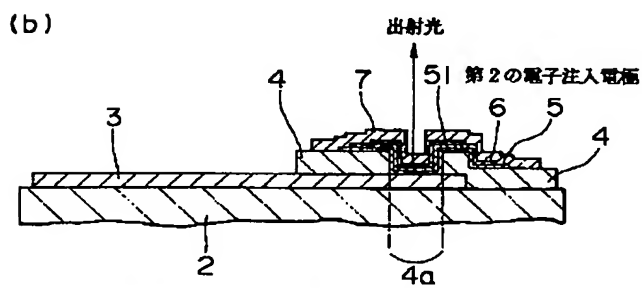
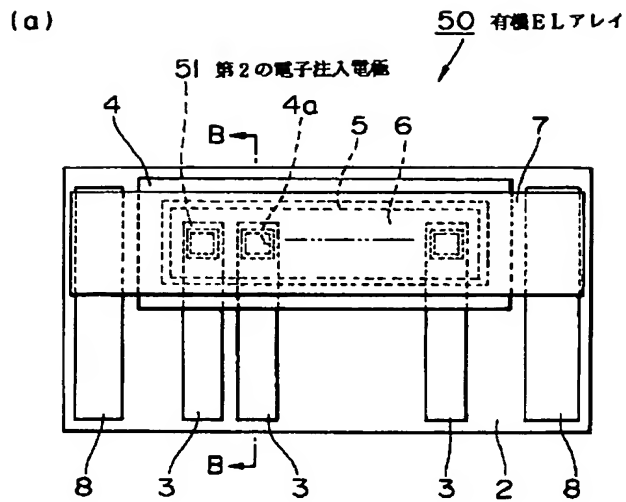
第3の実施形態例の概略構成図

[Drawing 5]




第4の実施形態例の概略構成図

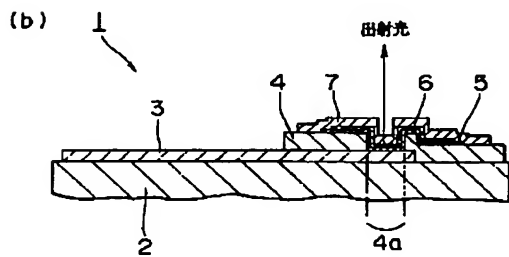
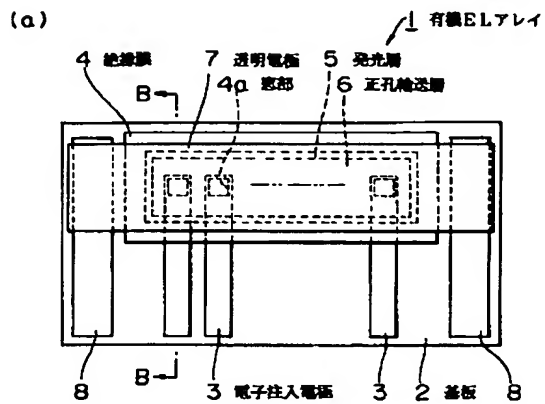
[Drawing 6]



第5の実施形態例の概略構成図

[Translation done.]

Drawing selection [R pr s ntative drawing] 



第1の実施形態例の概略構成図

[Translation done.]

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(5)Int.Cl. [*]	識別記号	庁内整理番号	P I	技術的示箇所
H05B 33/22			H05B 33/22	
B41J 2/44			H04N 1/036	A
2/45			B41J 3/21	L
2/455				
H04N 1/036				

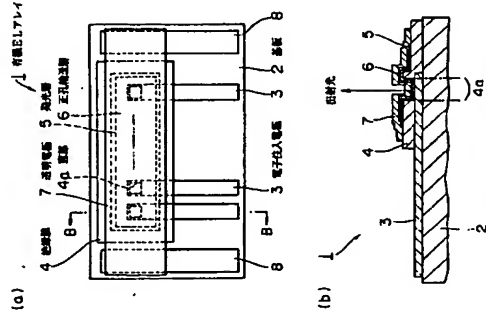
審査請求 未請求	請求項の数 5	OL (全 12 頁)
(21)出願番号	特開平9-212237	(71)出願人 00000295 神電気工業株式会社
(22)出願日	平成8年(1996) 8月12日	東京都港区虎ノ門1丁目7番12号 (72)発明者 小椋 茂樹 東京都港区虎ノ門1丁目7番12号 神電気 工業株式会社内 (72)発明者 佐野 広 東京都港区虎ノ門1丁目7番12号 神電気 工業株式会社内 (72)発明者 藤原 尚之 東京都港区虎ノ門1丁目7番12号 神電気 工業株式会社内 (74)代理人 弁理士 船橋 國昭 最終頁に続く

(54)【発明の名称】 有機ELアレイ

(57)【要約】

【課題】 実装上の困難さを回避し、低コスト化や高密度化を図ることのできる有機ELアレイの提供が望まれている。

【解決手段】 複数の発光ドットを有する有機ELアレイ1である。絶縁性基板2と、これの上に形成された電子注入電極3と、電子注入電極3の一部を覆って絶縁性基板2上に形成され、かつ電子注入電極3の直上部分で開口する発光ドットとなる窓部4aを有した絶縁膜4と、窓部4aを覆って窓部4a内から外に囲む電子注入電極3に接して形成された発光層5と、窓部4aの直上位置を覆って発光層5上にこれと接して形成された正孔輸送層6と、正孔輸送層6と発光層5とを覆い、かつ正孔輸送層6に接して絶縁性基板2上に形成された透明電極7と、を備えてなる。



第1の発光素子の断面図

【発明の要約】

【請求項1】 複数の発光ドットを有する有機ELアレイであって、

絶縁性基板と、

該絶縁性基板上に形成された前記発光ドットと、該発光ドットの電子注入電極と、

これら電子注入電極のそれぞれの一部を覆って前記絶縁性基板上に形成され、かつ該電子注入電極のそれぞれの直上部分で開口する発光ドットとなる窓部を有した絶縁膜と、

前記窓部を覆って該窓部内から外に囲む電子注入電極のそれぞれに接して形成された発光層と、

前記窓部の直上位置を覆って前記発光層上にこれと接して形成された正孔輸送層と、

該正孔輸送層と前記発光層とを覆い、かつ該正孔輸送層に接して前記絶縁性基板上に形成された透明電極と、を備えたことを特徴とする有機ELアレイ。

【請求項2】 請求項1記載の有機ELアレイにおいて、

前記電子注入電極は、前記絶縁膜の窓部内に位置する部分に、その厚さが該窓部の中心に向かって同心状に徐々に薄くなる凹部が設けられていることを特徴とする有機ELアレイ。

【請求項3】 請求項1記載の有機ELアレイにおいて、

前記電子注入電極は、前記絶縁膜の窓部内に位置する部分に、他の箇所に対して厚さの薄い環状部が形成されていることを特徴とする有機ELアレイ。

【請求項4】 請求項1記載の有機ELアレイにおいて、

前記絶縁性基板と電子注入電極との間には第2の絶縁膜が設けられ、

該第2の絶縁膜には、前記絶縁膜の窓部内に位置する部分に、その厚さが該窓部の中心に向かって同心状に徐々に薄くなる凹部が設けられ、

前記電子注入電極は、前記凹部上に該凹部の形状に沿った形状となっていることを特徴とする有機ELアレイ。

【請求項5】 請求項1記載の有機ELアレイにおいて、

少なくとも前記絶縁膜の窓部内に位置する部分には、前記電子注入電極および該窓部を形成する絶縁膜の側面に接して第2の電子注入電極が設けられ、

前記発光層は、前記第2の電子注入電極を覆って形成されたことを特徴とする有機ELアレイ。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】 本発明は、電子写真式プリンタにおける光プリンタヘッドに好適に用いられる有機EL (electroluminescence) アレイに関する。

【0002】

【従来の技術】 電子写真プリンタの光源としては、従来、例えば「電子写真学会誌 第24巻第2号(1985) 第3頁〜第36頁; LEDプリンタ (鈴木治、高須広雄、森田基夫)」に開示されているようなLEDアレイプリンタヘッドが知られている。このようなLEDアレイプリンタヘッドを備えたLEDプリンタは、光源であるLEDアレイがヘッドとしてソリッドステート化されており、またレーザプリンタのような機械的駆動部がないため高い信頼性が得られ、さらに光路長が短いため小型化が可能である。また、LEDアレイは、量産化種のある半導体製造技術で生産されているため、量産化による低コスト化を期待することができる。

【0003】 前記文献において開示されたLEDアレイでは、その印字プロセスは以下のような順序で進められる。まず、感光ドラムに帯電器を用いて一様な電荷を与える。次に、感光ドラム面にLEDアレイからの光を照射し、現像機により可視像とした、その後配電性ロッドレンズアレイを介して複製させ、潜像を形成する。次いで、現像機により可視像とした、その後配電性ロッドレンズアレイを介して複製させ、潜像を形成する。なお、感光ドラムについても、LEDの発光領域に合った感度特性をもつものが用いられている。

【0004】 また、このLEDプリンタにおいてLEDアレイを備えたLEDアレイプリンタヘッドは、アルミナセラミック基板に厚膜パターンを形成した基板を有し、この基板の中央部にLEDチップを一直線上に並べ、その両側にICチップを導電性ペーストにてタイガンドし、ワイヤボンディングによって電気的接続を行ったものである。但し、ワイヤボンディングは、FPC (フレキシブルプリント板) 基板を介してセラミック基板に供給されるようになっている。また、LEDチップを導電的に接続できなかつた場合、チップの切断精度によって決まるようになっている。

【0005】 ところで、LEDの材料には三つの特性が要求されている。

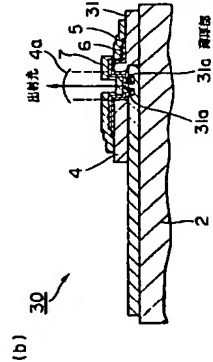
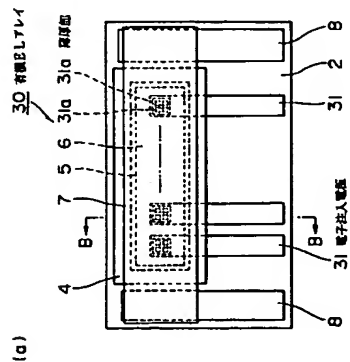
- a) 光のアイソレーションができること、
- b) 高密度化が可能な放電プロセスを要すること、
- c) 経済的価格で安定した特性が得られること、

の三つであり、このような要求を満たすものとしては、現在、GaAs基板上に気相成長したGaAsPが最適であるとされている。

【0006】 このようなLEDを製造するには、n型GaAsPウェハにCVD法等によって拡散防止膜を形成し、これにホトリソグラフィ法によって発光窓を開け、次に、ウェハおよびP型不純物を石英アンブレに真空封入し、約700℃の温度で数時間加熱を行い、発光窓にPN接合を形成する。このとき、拡散防止膜としては5〜7μmが適当である。

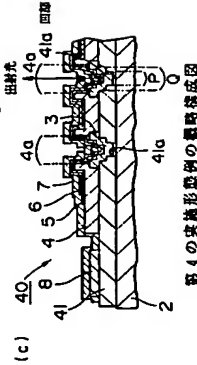
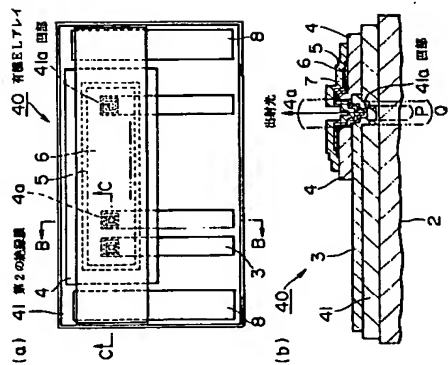
【0007】 次いで、P側にAl、N側にAu合金をそ

【図4】



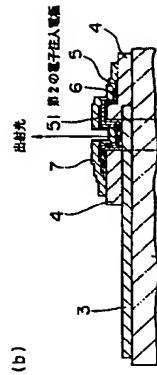
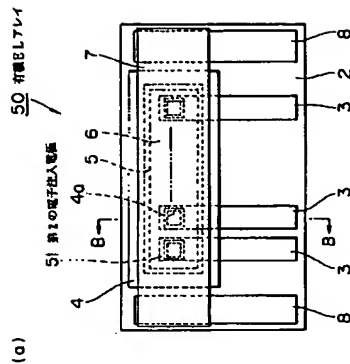
第3の実施形態例の概略構成図

【図5】



第4の実施形態例の概略構成図

【図6】



第5の実施形態例の概略構成図

フロントページの続き

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